

# INSTRUCTIONS/PARTS LIST



**307-671**

Rev D  
SUPERSEDES A  
and PCN B

This manual contains IMPORTANT  
WARNINGS and INSTRUCTIONS  
READ AND RETAIN FOR REFERENCE

## ULTRA<sup>®</sup> 400 AIRLESS PAINT SPRAYER

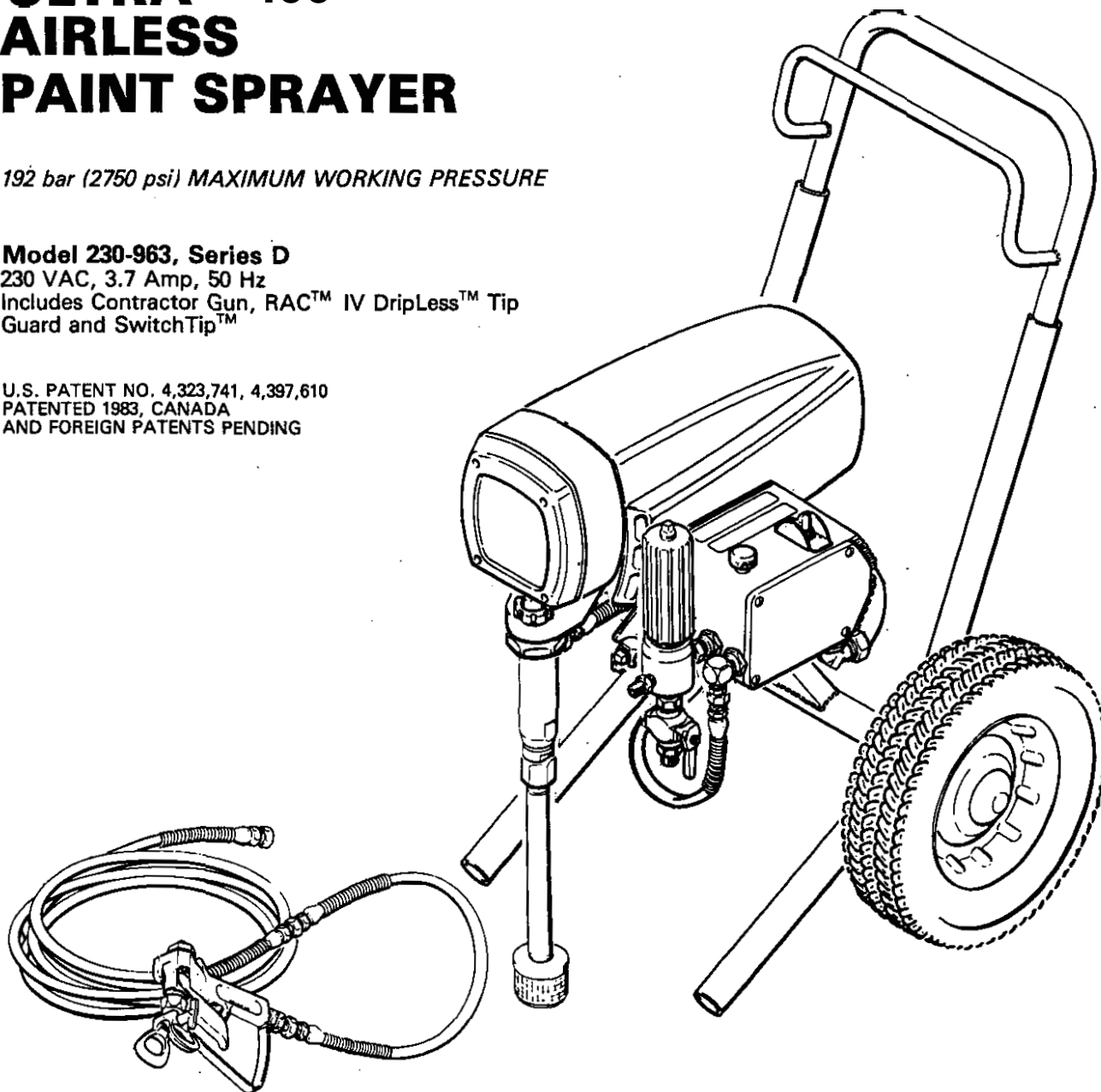
*192 bar (2750 psi) MAXIMUM WORKING PRESSURE*

### Model 230-963, Series D

230 VAC, 3.7 Amp, 50 Hz

Includes Contractor Gun, RAC<sup>™</sup> IV DripLess<sup>™</sup> Tip  
Guard and SwitchTip<sup>™</sup>

U.S. PATENT NO. 4,323,741, 4,397,610  
PATENTED 1983, CANADA  
AND FOREIGN PATENTS PENDING



### WARNING

**Hazard of Using Fluids Containing Halogenated Hydrocarbons**

Never use 1,1,1-trichloroethane, methylene chloride, other halogenated hydrocarbon solvents or fluids containing such solvents in this equipment. Such use could result in a serious chemical reaction, with the possibility of explosion, which could cause death, serious bodily injury and/or substantial property damage.

Consult your fluid suppliers to ensure that the fluids being used are compatible with aluminum and zinc parts.

**GRACO INC. P.O. Box 1441 MINNEAPOLIS, MN 55440-1444**

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# WARNING

## HIGH PRESSURE SPRAY CAN CAUSE EXTREMELY SERIOUS INJURY.

FOR PROFESSIONAL USE ONLY. OBSERVE ALL WARNINGS.

Read and understand all instruction manuals, tags, and warnings before operating equipment.

### FLUID INJECTION HAZARD

#### General Safety

This equipment generates very high fluid pressure. Spray from the gun, leaks or ruptured components can inject fluid through your skin and into your body and cause extremely serious bodily injury, including the need for amputation. Also, fluid injected or splashed into the eyes or onto the skin can cause serious damage.

NEVER point the spray gun at anyone or any part of the body. NEVER put hand or fingers over the spray tip. NEVER try to "blow back" paint; this is NOT an air spray system.

ALWAYS have the tip guard in place on the spray gun when spraying.

ALWAYS follow the Pressure Relief Procedure, below, before cleaning or removing the spray tip or servicing any system equipment.

NEVER try to stop or deflect leaks with your hand or body.

Be sure equipment safety devices are operating properly before each use.

#### Medical Alert — Airless Spray Wounds

If any fluid appears to penetrate your skin, get **EMERGENCY MEDICAL CARE AT ONCE. DO NOT TREAT AS A SIMPLE CUT.** Tell the doctor exactly what fluid was injected.

**Note to Physician:** injection in the skin is a traumatic injury. It is important to treat the injury surgically as soon as possible. Do not delay treatment to research toxicity. Toxicity is a concern with some exotic coatings injected directly into the blood stream. Consultation with a plastic surgeon or reconstructive hand surgeon may be advisable.

#### Spray Gun Safety Devices

Be sure all gun safety devices are operating properly before each use. Do not remove or modify any part of the gun; this can cause a malfunction and result in serious bodily injury.

#### Safety Latch

Whenever you stop spraying, even for a moment, always set the gun safety latch in the closed or "safe" position, making the gun inoperative. Failure to set the safety latch can result in accidental triggering of the gun.

#### Diffuser

The gun diffuser breaks up spray and reduces the risk of fluid injection when the tip is not installed. Check diffuser operation regularly. Follow the Pressure Relief Procedure, below, then remove the spray tip. Aim the gun into a metal pail, holding the gun firmly to the pail. Using the lowest possible pressure, trigger the gun. If the fluid emitted is not diffused into an irregular stream, replace the diffuser immediately.

#### Tip Guard

ALWAYS have the tip guard in place on the spray gun while spraying. The tip guard alerts you to the fluid injection hazard and helps reduce, but does not prevent, the risk of accidentally placing your fingers or any part of your body close to the spray tip.

#### Spray Tip Safety

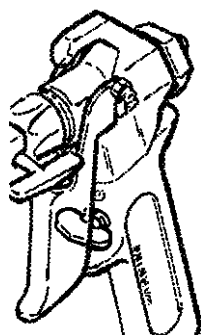
Use extreme caution when cleaning or changing spray tips. If the spray tip clogs while spraying, engage the gun safety latch immediately. ALWAYS follow the Pressure Relief Procedure and then remove the spray tip to clean it.

NEVER wipe off build-up around the spray tip until pressure is fully relieved and the gun safety latch is engaged.

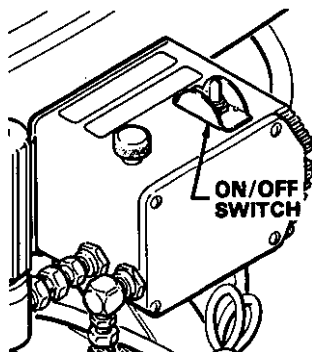
#### Pressure Relief Procedure

To reduce the risk of serious bodily injury, including fluid injection, injury from splashing fluid or solvent in the eyes or on the skin, moving parts or electric shock, always follow this procedure whenever you shut off the sprayer, when checking or servicing any part of the spray system, when installing, cleaning or changing spray tips, and whenever you stop spraying. (1) Engage the gun safety latch. (2) Turn the ON/OFF switch to OFF. (3) Unplug the power supply cord. (4) Disengage the gun safety latch. (5) Hold a metal pan of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure. (6) Engage the gun safety latch. (7) Open the drain valve, having a container ready to catch the drainage. (8) Leave the drain valve open until you are ready to spray again.

If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, VERY SLOWLY loosen the tip guard retaining nut or hose end coupling and relieve pressure gradually, then loosen completely. Now clear the tip or hose.



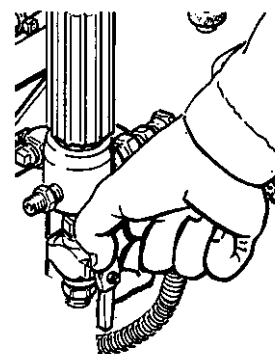
ENGAGE SAFETY LATCH



TURN SWITCH TO OFF  
UNPLUG CORD



DISENGAGE SAFETY  
AND TRIGGER GUN;  
ENGAGE SAFETY AGAIN



OPEN DRAIN VALVE

## EQUIPMENT MISUSE HAZARD

### General Safety

Any misuse of the spray equipment or accessories, such as overpressurizing, modifying parts, using incompatible chemicals and fluids, or using worn or damaged parts, can cause them to rupture and result in fluid injection or other serious bodily injury, fire, explosion or property damage.

NEVER alter or modify any part of this equipment; doing so could cause it to malfunction.

CHECK all spray equipment regularly and repair or replace worn or damaged parts immediately.

Read and follow the fluid and solvent manufacturer's literature regarding the use of protective clothing and equipment.

### System Pressure

This sprayer can develop **192 bar (2750 psi) MAXIMUM WORKING PRESSURE**. Be sure that all spray equipment and accessories are rated to withstand the maximum working pressure of this sprayer. DO NOT exceed the maximum working pressure of any component or accessory used in the system.

### Fluid Compatibility

BE SURE that all fluids and solvents used are chemically compatible with the wetted parts shown in the Technical Data on the back cover. Always read the fluid and solvent manufacturer's literature before using them in this sprayer.

## HOSE SAFETY

High pressure fluid in the hoses can be very dangerous. If the hose develops a leak, split or rupture due to any kind of wear, damage or misuse, the high pressure spray emitted from it can cause a fluid injection injury or other serious bodily injury or property damage.

ALL FLUID HOSES MUST HAVE SPRING GUARDS ON BOTH ENDS! The spring guards help protect the hose from kinks or bends at or close to the coupling which can result in hose rupture.

TIGHTEN all fluid connections securely before each use. High pressure fluid can dislodge a loose coupling or allow high pressure spray to be emitted from the coupling.

NEVER use a damaged hose. Before each use, check the entire hose for cuts, leaks, abrasion, bulging cover, or damage or movement of the hose couplings. If any of these conditions exist, replace the hose immediately. DO NOT try to recouple high pressure hose or mend it with tape or any other device. A repaired hose cannot contain the high pressure fluid.

HANDLE AND ROUTE HOSES CAREFULLY. Do not pull on hoses to move equipment. Do not use fluids or solvents which are not compatible with the inner tube and cover of the hose. DO NOT expose Graco hose to temperatures above 82°C (180°F) or below -40°C (-40°F).

### Hose Grounding Continuity

Proper hose grounding continuity is essential to maintaining a grounded spray system. Check the electrical resistance of your air and fluid hoses at least once a week. If your hose does not have a tag on it which specifies the maximum electrical resistance, contact the hose supplier or manufacturer for the maximum resistance limits. Use a resistance meter in the appropriate range for your hose to check the resistance. If the resistance exceeds the recommended limits, replace it immediately. An ungrounded or poorly grounded hose can make your system hazardous. Also read FIRE OR EXPLOSION HAZARD.

## FIRE OR EXPLOSION HAZARD

Static electricity is created by the flow of fluid through the pump and hose. If every part of the spray equipment is not properly grounded, sparking may occur, and the system may become hazardous. Sparking may also occur when plugging in or unplugging a power supply cord. Sparks can ignite fumes from solvents and the fluid being sprayed, dust particles and other flammable substances, whether you are spraying indoors or outdoors, and can cause a fire or explosion and serious bodily injury and property damage. Always plug the sprayer into an outlet at least 6 m (20 feet) away from the sprayer and the spray area. Do not plug in or unplug any power supply cords in the spray area when there is any chance of igniting fumes still in the air.

If you experience any static sparking or even a slight shock while using this equipment, STOP SPRAYING IMMEDIATELY. Check the entire system for proper grounding. Do not use the system again until the problem has been identified and corrected.

### Grounding

To reduce the risk of static sparking, ground the sprayer and all other spray equipment used or located in the spray area. CHECK your local electrical code for detailed grounding instructions for your area and type of equipment, BE SURE to ground all of this spray equipment:

1. Sprayer: plug the power supply cord, or extension cord, each equipped with an undamaged three-prong plug, into a properly grounded outlet. Do not use an adapter. All extension cords must have three wires and be rated for 15 amps.
2. Fluid hoses: use only grounded hoses with a maximum of 500 feet (150 m) combined hose length to ensure grounding continuity. Refer to Hose Grounding Continuity.
3. Spray gun: obtain grounding through connection to a properly grounded fluid hose and sprayer.
4. Fluid supply container: according to local code.
5. Object being sprayed: according to local code.
6. All solvent pails used when flushing, according to local code. Use only metal pails, which are conductive. Do not place the pail on a non-conductive surface, such as paper or cardboard, which interrupts the grounding continuity.
7. To maintain grounding continuity when flushing or relieving pressure, always hold a metal part of the gun firmly to the side of a grounded metal pail, then trigger the gun.

### Flushing Safety

Reduce the risk of fluid injection injury, static sparking, or splashing by following the specific flushing procedure given on page 8 of this manual. Follow the Pressure Relief Procedure on page 2, and remove the spray tip before flushing. Hold a metal part of the gun firmly to the side of a metal pail and use the lowest possible fluid pressure during flushing.

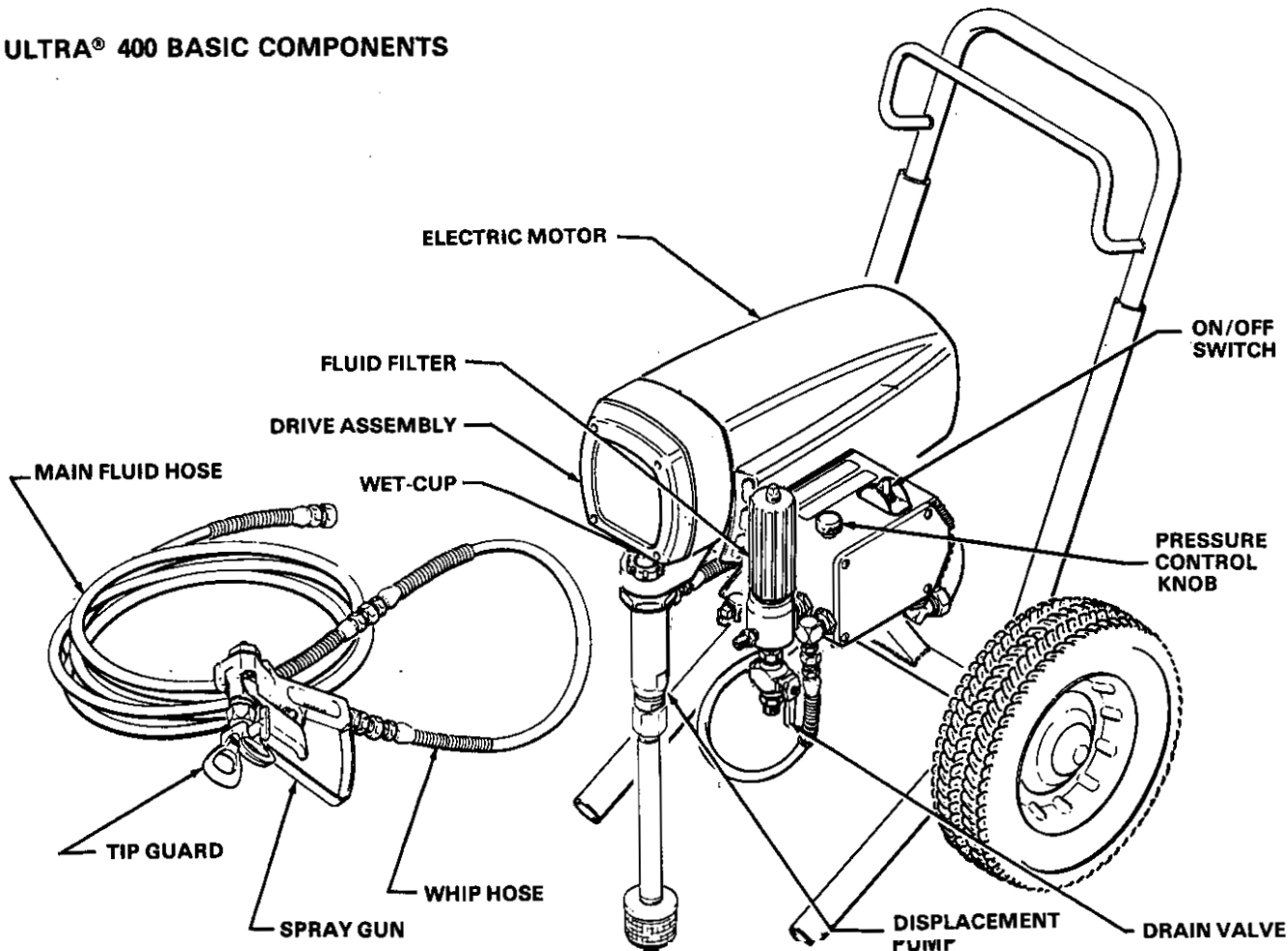
## MOVING PARTS HAZARD

Moving parts can pinch or amputate your fingers or other body parts. KEEP CLEAR of moving parts when starting or operating the sprayer. Unplug the sprayer, and follow the Pressure Relief Procedure on page 2 to prevent it from starting accidentally.

## IMPORTANT

United States Government safety standards have been adopted under the Occupational Safety and Health Act. These standards — particularly the General Standards, Part 1910, and the Construction Standards, Part 1926 — should be consulted.

## ULTRA® 400 BASIC COMPONENTS



Your new Ultra® 400 Sprayer functions and operates differently than other airless paint sprayers. This section will help you become familiar with the sprayer before operating it.

### Pressure Control

The pressure control includes an **ON/OFF** switch for the sprayer, the pressure adjusting control knob, and a pressure sensing device. Its function is to control the motor speed so that the sprayer maintains constant fluid pressure at the pump outlet.

### Motor

The DC motor has sealed bearings and replaceable motor brushes. Its function is to drive the displacement pump at the rate needed to supply sufficient paint volume at the selected pressure.

Working together, the pressure control and motor cause the pump to cycle whenever there is fluid or pressure demand. When the pump is cycling, the motor sounds like an automobile starter cranking. When the pump is not cycling, the motor may hum intermittently until the fluid pressure stabilizes, then the motor will shut itself off. However, there will still be power to the sprayer and it will stay pressurized and ready to use unless you manually shut it off and relieve pressure.

Because the motor is DC, it is less sensitive to low voltage or voltage fluctuations than an AC motor, and an extension cord of up to 45 m (150 feet) can be used.

### Drive Assembly

The sealed drive assembly transfers power from the DC motor to the displacement pump.

### Displacement Pump

The positive displacement, volume-balanced pump provides equal fluid delivery on both the up and down pump strokes. The pump has a wet-cup which, when filled with Graco Throat Seal Liquid, helps prevent damage to the throat packings and piston rod.

### Fluid Filter

The fluid filter provides the final paint straining to help avoid clogs in the hose and spray tip. The filter includes a reusable element and a drain valve for relieving fluid pressure when shutting off the sprayer.

### Hoses

Two grounded, nylon spray hoses with spring guards are included with the sprayer. The 15.2 m (50 foot) hose has a 1/4 in. ID. The 0.9 m (3 foot), 3/16 in. ID whip hose allows flexible gun movement. The nylon hose material acts as a pulsation dampener to absorb pressure fluctuations.

### Spray Gun & Reverse-A-Clean™ IV DripLess™ Tip Guard

The spray gun includes a trigger safety latch which prevents accidental triggering when it is engaged (see the WARNING on page 2) and a trigger guard which prevents accidental triggering if the gun is dropped. The Reverse-A-Clean IV SwitchTip™ uses high pressure fluid to remove clogs from the spray tip without removing it from the gun. It includes a safety tip guard which helps reduce the risk of fluid injection injury.

## SETUP

### 1. Connect **Hose** and Gun (Refer **to** Fig 1.)

**NOTE:** When tightening fittings at the pressure control, hold one wrench firmly on the **hex** of the pressure control fitting **to** keep it from rotating. Use another wrench **to** tighten the mating fitting.

- Remove the plastic cap plug from the filter outlet nipple and tightly screw the **15.2 m (50 ft)** fluid hose onto the nipple.
- Tightly connect the whip hose between the fluid hose and the gun inlet connection.
- Don't use thread sealant on swivel couplings. The sealant can prevent the swivel from rotating freely.
- Don't install the spray tip yet!

### CAUTION

**To avoid damaging the pressure control, which may result in poor equipment performance and component damage, follow these precautions:**

- Always use nylon spray hose at least **15.2 m (50 ft)** long.
- Never use a wire braid hose as it is too rigid to act as a pulsation dampener.
- Never install any shutoff device between the filter and the main hose. See Fig 1.
- Always use the main filter outlet for one-gun operation. Never plug this outlet.

### 2. Fill Packing Nutiwet-Cup (See Fig 2.) Fill the packing nut/wet-cup **1/3** full with Graco Throat Seal Liquid (TSL), supplied.

### 3. Check Electrical Service

- Be sure the electrical service is properly rated for your sprayer and that the outlet you use is properly grounded.
- Attach an appropriate plug to the power supply cord, according **to** your local electrical codes.
- Use an extension cord which has **3** wires of a minimum **12** gauge size, and a maximum of **45 m (150 ft)** long. Longer lengths may affect sprayer performance.

### 4. Plug in the Sprayer

- Be sure the ON/OFF switch is OFF. Refer **to** Fig 3. Then plug the cord into a grounded electrical outlet at least **6 m (20 ft)** away from the spray area.

### WARNING

Proper electrical grounding is essential **to** reduce the risk of fire or explosion which can result in serious bodily injury and property damage. Refer to the warning section **FIRE OR EXPLOSION HAZARD** on page 3 for more detailed grounding instructions.

- Flush the pump to remove the lightweight oil which was left in to protect pump parts after factory testing.
  - Before using water-base paint, flush with mineral spirits followed by soapy water, and then a clean water flush.

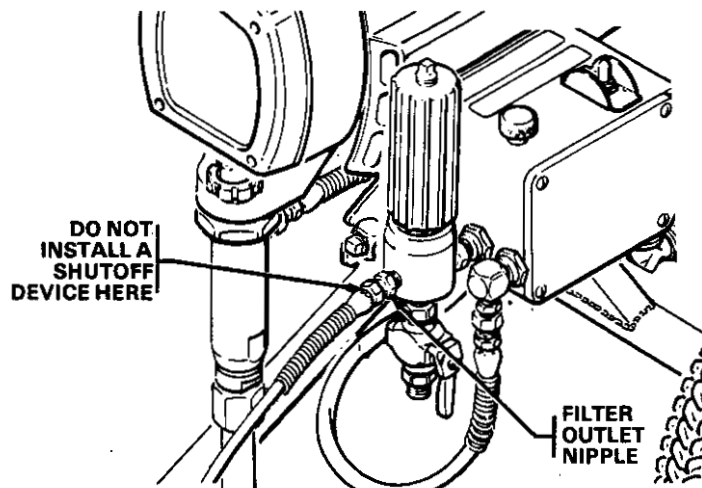


Fig 1

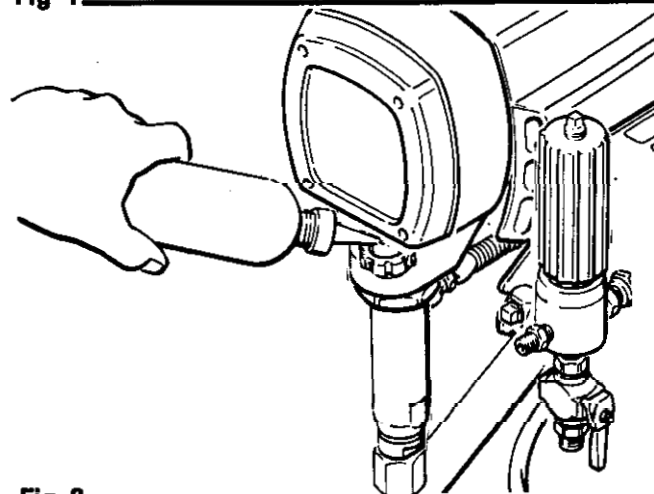


Fig 2

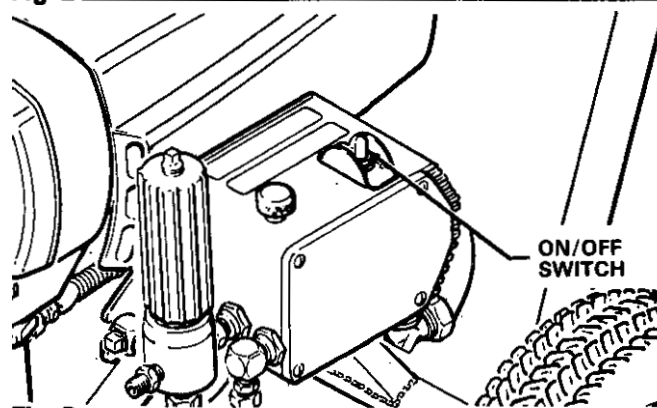


Fig 3

- Before using oil-base *paint*, flush with mineral spirits only.
  - See "**Flushing Guidelines**" on page 8 for flushing procedure.
- Prepare the paint according **to** the manufacturer's recommendations.
    - Remove any skin that may have formed.
    - Stir the paint **to** dissolve hard pigments.
    - Strain the paint through a **fine** nylon mesh bag (available at most paint dealers) **to** remove particles that could clog the filter or spray tip. This is **probably the most important** step toward **trouble-free** spray painting.

## WARNING

### Pressure Relief Procedure

To reduce the risk of serious bodily injury, including fluid injection, injury from splashing fluid or solvent in the eyes or on the skin, moving parts or electric shock, always follow this procedure whenever you shut off the sprayer, when checking or servicing any part of the spray system, when installing, cleaning or changing spray tips, and whenever you stop spraying.

1. Engage the gun safety latch.
2. Turn the ON/OFF switch to OFF.
3. Unplug the power supply cord.
4. Disengage the gun safety latch.
5. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure.
6. Engage the gun safety latch.
7. Open the filter drain valve, having a container ready to catch the drainage.
8. Leave the drain valve open until you are ready to operate the sprayer again.

### Prime the Sprayer with Paint.

- a. Close the filter drain valve.
- b. Don't install the spray tip yet!
- c. Put the suction tube into the paint container.
- d. Turn the pressure adjusting knob all the way counterclockwise to the lowest pressure setting.
- e. Disengage the gun safety latch.
- f. Hold a metal part of the gun firmly against and aimed into a metal waste container.. See Fig 4. Squeeze the trigger and hold it open, turn the ON/OFF switch to ON, and slowly increase the pressure setting until the sprayer starts. Keep the gun triggered until all air is forced out of the system and the paint flows freely from the gun. Release the trigger and engage the safety.

**NOTE:** If the pump is hard to prime, place a container under the drain valve and open the drain valve. When fluid comes from the valve, close it. Then disengage the gun safety and proceed as in Step 1f, above.

- g. Check all fluid connections for leaks. If any are found, follow the Pressure Relief Procedure Warning, above, before tightening connections.

## 2. Install the Spray Tip and Tip Guard

- a. Be sure the gun safety latch is engaged.
- b. Install the spray tip. If using the RAC IV, refer to manual 307-848, supplied with the gun, for installation instructions.

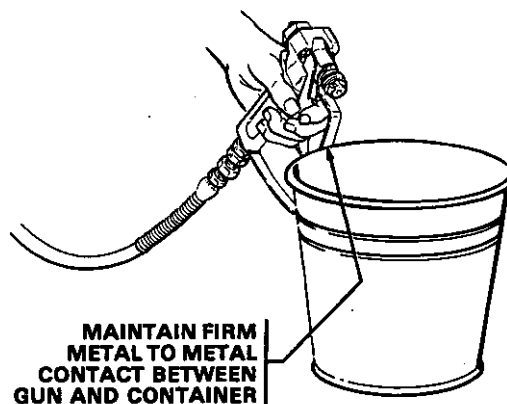


Fig 4.

## 3. Adjusting the Spray Pattern

- a. Increase the pressure adjusting knob setting just until spray from the gun is completely atomized. To avoid excessive overspray and fogging, and to decrease tip wear and extend the life of the sprayer, always use the lowest possible pressure needed to get the desired results.
- b. If more coverage is needed, use a larger tip rather than increasing the pressure.
- c. Test the spray pattern. To adjust the direction of the spray pattern, engage the gun safety and loosen the retaining nut. Position the tip guard horizontally for a horizontal pattern or vertically for a vertical pattern. Then tighten the retaining nut.

#### 4. Cleaning a Clogged Tip

##### WARNING

To avoid a fluid injection injury, **DO NOT** hold your hand, body, or a rag in front of the spray tip when cleaning or checking a clogged tip. Always point the gun toward the ground or into a waste container when checking to see if the tip is clear.

**DO NOT** try to "blow back" paint; this is **NOT** an air spray sprayer.

- Clean the front of the tip frequently during the day's operation. **First**, follow the Pressure Relief Procedure Warning on page 6. Then **use** a solvent-soaked brush to keep fluid from building up and clogging the tip.
- If the spray tip does clog, release the gun trigger, engage the gun safety, and rotate the RAC IV handle 180°. See Fig 5.
- Disengage the gun safety and trigger the gun into a waste container. Engage the gun safety again.
- Return the handle to the original position, disengage the gun safety, and resume spraying.
- if the tip is still dogged**, engage the gun safety, shutoff and unplug the sprayer, and open the drain valve to relieve pressure. Clean the spray tip as shown in manual 307-848, supplied with the RAC IV DripLess tip guard.

#### SHUTDOWN AND CARE

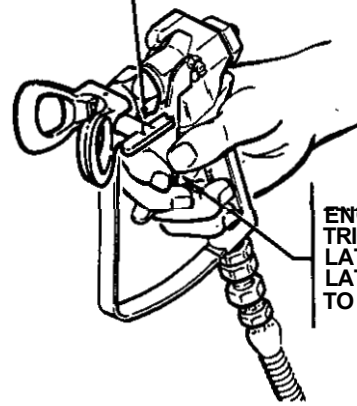
- Check the packing **nut/wet-cup** daily. First follow the Pressure Relief Procedure Warning on page 6. Be sure the wet-cup is **1/3** full of TSL at all times to help prevent fluid buildup on the piston rod and premature wear of packings. The packing nut should be tight enough to stop leakage, but not tighter. Overtightening may cause binding and excessive packing wear. **Use** a screwdriver and light hammer to adjust the nut. See Fig 6.
- Clean** the fluid filter often and whenever the sprayer is stored. First follow the Pressure Relief Procedure Warning on page 6. Refer to manual 307-273, supplied, for the cleaning procedure.
- Lubricate the bearing housing after every **100** hours of operation. Fill the cavity of the bearing housing with SAE **10** nondetergent oil.
- Flush the sprayer at the end of **each** work day and fill it with mineral spirits to help prevent pump corrosion and freezing. See "Flushing Guidelines" on page 8.

##### CAUTION

To prevent pump corrosion, and to reduce the chance of fluid freezing in the pump or pressure control in cold weather, never leave water or any type of paint in the sprayer when it is not in use. Freezing can seriously damage the sprayer and result in loss of pressure or stalling.

- For very short shutoff periods, leave the suction tube in the paint, follow the Pressure Relief Procedure Warning on page 6, and clean the spray tip.

ROTATE RAC IV  
HANDLE 180°



ENGAGE THE  
TRIGGER SAFETY  
LATCH BY TURNING  
LATCH PERPENDICULAR  
TO GUN BODY

Fig 5

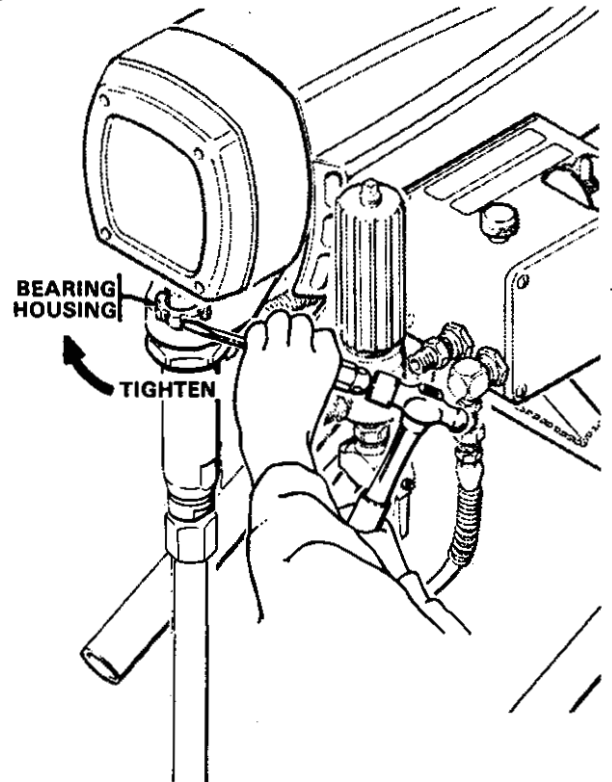


Fig 6

- Coil the hose and hang it on the hose rack when storing it, even for overnight, to help protect the hose from kinking, abrasion, coupling damage, etc.

##### WARNING

Refer to the warning section **HOSE SAFETY** on page 3 for information on the hazard of using damaged hoses.



## FLUSHING GUIDELINES

### When to Flush

1. **New Sprayer.** Your new Ultra® 400 Sprayer was factory tested in lightweight motor oil which was left in to protect pump parts. Before using water-base paint, flush with mineral spirits, followed by soapy water, and then a clean water flush. Before using oil-base paint, flush with mineral spirits only.
2. **Changing Colors.** Flush with a compatible solvent such as mineral spirits or water.
3. **Changing from water-base to oil-base paint.** Flush with soapy water, then mineral spirits.
4. **Changing from oil-base to water-base paint.** Flush with mineral spirits, followed by soapy water, then a clean water flush.
5. **Storage.**  
Water-base paint: flush with water, then mineral spirits and leave the pump, hose and gun filled with mineral spirits. Shutoff and unplug the sprayer, open the drain valve to relieve pressure and leave open.  
Oil-base paint: flush with mineral spirits. Shutoff and unplug the sprayer, open the drain valve to relieve pressure and leave open.
6. **Startup after storage.**  
Before using water-base paint, flush out mineral spirits with soapy water and then a clean water flush.  
When using oil-base paint, flush out the mineral spirits with the fluid to be sprayed and the sprayer is ready to use.

### How to Flush

1. Follow the Pressure Relief Procedure Warning on page 6.
2. Remove the filter bowl and screen; see manual 307-273 supplied. Clean the screen separately and install the bowl without the screen.

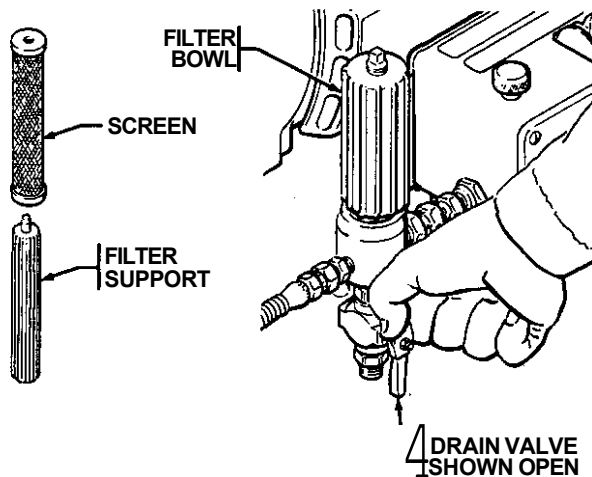


Fig 7

3. Close the filter drain valve.
4. Pour 2 liters (1/2 gal.) of compatible solvent into a bare metal pail. Put the suction tube in the pail.

#### WARNING

Always remove the spray tip from the gun before flushing to reduce the risk of a fluid injection injury.

5. Disengage the gun safety latch.
6. Point the spray gun into a grounded metal waste container and with a metal part of the gun firmly touching the metal container, squeeze the gun trigger. **This** procedure helps avoid static sparking which can cause fire or explosion and splashing. With the gun triggered, turn the ON/OFF switch to **ON** and slowly turn the pressure adjusting knob clockwise **just** until the sprayer starts. Keep the gun triggered until clean solvent comes from the nozzle. Release the trigger and engage the gun safety latch.
7. Check all fluid connections for leaks. If any leak, follow the Pressure Relief Procedure Warning on page 6. Now tighten the connections, start the sprayer, and recheck the connections for leaks.
8. Remove the suction tube from the pail. Disengage the gun safety and trigger the gun to force solvent from the hose. **Do** not let the pump run dry for more than 30 seconds to avoid damaging the pressure control. Then turn ON/OFF switch to OFF and engage the gun safety latch.
9. Unplug the power supply cord. Open the drain valve and leave open until you are ready to use the sprayer again. Unscrew the filter bowl and reinstall the clean screen. Reinstall the bowl, hand tight only.
10. If you have flushed with mineral spirits and are going to use a water-base paint, flush with soapy water followed by a clean water flush. Then repeat Step 1.

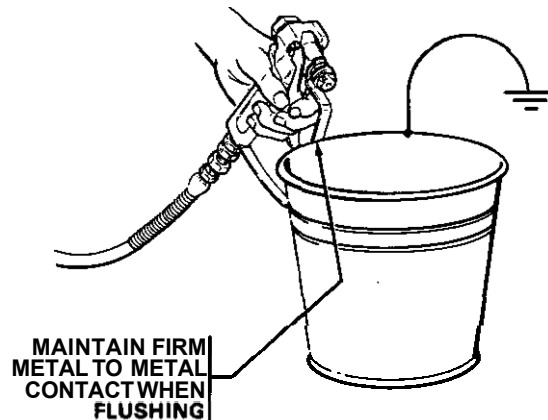


Fig 8

**WARNING****Pressure Relief Procedure**

To reduce the risk of serious bodily injury, including fluid injection, splashing fluid in the eyes or on the skin, or injury from moving parts or electric shock, always follow this procedure whenever you shut off the sprayer, when checking or servicing any part of the spray system, when installing, cleaning or changing spray tips, and whenever you stop spraying.

1. Engage the gun safety latch.
2. Turn the ON/OFF switch to **OFF**.
3. Unplug the power supply cord.
4. Disengage the gun safety latch.
5. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure.

6. Engage the gun safety latch.
7. Open the drain valve, having a container ready to catch the drainage.
8. Leave the drain valve open until you are ready to spray again.

If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, **VERY SLOWLY** loosen the tip guard retaining nut or hose end coupling and relieve pressure gradually, then loosen completely. Now clear the tip or hose.

TYPE OF PROBLEM	WHAT TO CHECK If check is OK, go to next check	WHAT TO DO If check is NOT OK refer to this column
<b>MOTOR WON'T OPERATE</b>  Basic Fluid Pressure Problems	<ol style="list-style-type: none"> <li>1. Check the pressure control knob setting. The motor will not run if it is at the minimum setting (fully counterclockwise).</li> <li>2. Check for a clogged spray tip. Refer to your separate gun or tip instruction manual.</li> </ol>	<ol style="list-style-type: none"> <li>1. Slowly increase the pressure setting to see if the motor starts.</li> <li>2. Relieve pressure, refer to your separate gun or tip instruction manual for tip cleaning.</li> </ol>
Basic Mechanical Problems	<ol style="list-style-type: none"> <li>1. Check for frozen or hardened paint in the pump (19) and/or pressure control bourdon tube. Using a screwdriver, carefully try to rotate fan at back of motor. See page 15.</li> <li>2. Check displacement pump connecting rod pin (20). It must be completely pushed into connecting rod (9) and spring retainer (21) should be firmly in groove of connecting rod. See page 26.</li> <li>3. Check for motor damage. Remove drive housing assembly (6). See page 25. Try to rotate fan by hand.</li> </ol>	<ol style="list-style-type: none"> <li>1. Thaw*. Plug in sprayer and turn on. Slowly increase pressure setting to see if motor starts. If it doesn't, replace the displacement pump packings (see manual 307-793) and/or replace the bare pressure control box (301)†. See page 23.</li> <li>2. Push pin into place and secure with the spring retainer.</li> <li>3. Replace motor (11 if fan won't turn).</li> </ol>
Basic Electrical Problems	<ol style="list-style-type: none"> <li>1. Check electrical supply with volt meter. Meter should read 190-250 Volts.</li> <li>2. Check extension cord for visible damage. Use a volt meter or test lamp at extension cord outlet to check.</li> <li>3. Check sprayer power supply cord (311) for visible damage such as broken insulation or wires.</li> <li>4. Check motor brush leads, terminals and brush length. Brush length should be 14 mm minimum. See page 28.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reset building circuit breaker; replace building fuse. Try another electrical outlet.</li> <li>2. Replace extension cord.</li> <li>3. Replace power supply cord. See page 18.</li> <li>4. Tighten terminal screws; replace brushes. See page 27.</li> </ol>

\*Thaw the sprayer if water or water-based paint has frozen in it, due to exposure to low temperatures, by placing it in a warm area. Do not try to start the sprayer until it has thawed completely. If the bourdon tube was not damaged by the freezing, the pump should operate. If paint hardened (dried) in the sprayer, the pump packings and/or bare pressure control must be replaced. See page 23 or manual 307-793.

†When replacing the bare pressure control box (item 301), remove the ON/OFF switch, bridge, circuit board and electrical hardware and reinstall these parts in the bare box.

Troubleshooting continued on next page.

TYPE OF PROBLEM	WHAT TO CHECK If check is <b>OK</b> , go to next check	WHAT TO DO If check is <b>NOT OK</b> refer to this column
<p><b>MOTOR WON OPERATE</b></p> <p>Diagnosing circuit board indicator lamps. The normal condition is red lamp on, clear lamp <b>on</b> when board is <i>telling pump to run</i>.</p> <p>Follow Pressure Relief Procedure Warning. Remove gun from hose. Remove pressure control cover and check for faulty condition of circuit board lamps.</p> <p>Condition A both lamps on; pump won't operate and motor is not running</p>	<ol style="list-style-type: none"> <li>1. Check leads from bridge (308) to motor to be sure they are securely fastened and properly mated.</li> <li>2. Check G1 and G2 connections between circuit board (340) and bridge (308) for damage or loose terminals.</li> <li>3. Check for loose motor brush lead connections and terminals. See page 27.</li> <li>4. Check brush length which should be 14 mm minimum. See page 27. NOTE also that the brushes do not wear at the same rate on both sides of the motor.</li> <li>5. Check for broken or misaligned motor brush springs. Rolled portion of spring must rest squarely on top of brush. See page 27.</li> <li>6. Check motor brushes for binding in brush holders. See page 27.</li> <li>7. Check motor armature commutator for burn spots, gouges and extreme roughness. Remove motor cover and brush inspection plates to check. See page 27.</li> <li>8. Check motor armature for shorts using armature tester (growler) or perform spin test. See page 15.</li> <li>9. Check bridge (308) by substituting with a good bridge or performing bridge test. See page 16. <b>CAUTION:</b> Do not perform this check until armature is determined to be good. A bad armature will immediately burn out a good bridge.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace any loose terminals and crimp to leads. Be sure male terminal blades are straight and firmly connected to mating part.</li> <li>2. Clean circuit board male terminals. Replace loose or damaged terminals. Securely reconnect leads.</li> <li>3. Tighten terminal screws. Replace brushes if leads are damaged. See page 27.</li> <li>4. Replace brushes. See page 27.</li> <li>5. Replace spring if broken. Realign spring with brush. See page 27.</li> <li>6. Clean brush holders. Remove carbon with small cleaning brush. Align brush lead with slot in brush holder to assure free vertical brush movement.</li> <li>7. Remove motor and have motor shop resurface commutator if possible. See page 27.</li> <li>8. Replace motor. See page 29</li> <li>9. Replace bridge. See page 20.</li> </ol>
<p>Condition B Both lamps <b>off</b></p>	<ol style="list-style-type: none"> <li>1. Check electrical supply. Connect voltmeter to electrical outlet. Meter should read 190-250 Volts.</li> <li>2. Check power supply to circuit board with sprayer turned ON. Measure voltage at TP1 and TP2. Meter should read 190-250 Volts. See page 22.</li> <li>3. Check all terminals and wires for damage or loose fit.</li> <li>4. Check motor thermal cutout switch. Unplug sprayer. Allow motor to cool. Disconnect motor thermal switch leads at TP9 to TP10. Use ohmmeter to check continuity. Switch should be closed when motor is cool.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reset circuit breaker or replace outlet fuse. If circuit breaker or fuse continues to open, see "Electrical Short", page 14.</li> <li>2. Unplug sprayer. Check continuity of both poles of ON/OFF switch (302) from TP1 to TP2, and TP2 to TP3. Replace switch if faulty.  Check continuity of RFI filter (3101) from TP4 to TP6 and TP3 to TP5. Replace filter if faulty.  Check power supply cord (3111) for continuity from TP5 to TP7 and TP6 to TP8. Replace cord if faulty.  <b>Check for any loose connections.</b></li> <li>3. Replace damaged terminals and reconnect securely.</li> <li>4. Replace electric motor if switch does not close when motor is cool. See page 29</li> </ol>

TYPE OF PROBLEM	WHAT TO CHECK If check is OK, go to next check	WHAT TO DO If check is NOT OK refer to this column
Condition B (continued)	<ol style="list-style-type: none"> <li>i. Check microswitch (306). With no fluid pressure in the pressure control disconnect wires TP18 and TP19. Check continuity across switch terminals with an ohmmeter. Switch contact should be closed. Depress actuator button. An audible "click" indicates the contacts have opened. Ohmmeter should read infinity.</li> <li>ii. Check circuit board (340) by substituting with a good board. See page 22</li> </ol>	<ol style="list-style-type: none"> <li>5. Replace microswitch. See page 19.</li> <li>3. Replace circuit board. See page 22</li> </ol>
Condition C Red lamp on, clear lamp off <b>Unplug sprayer!</b>	<ol style="list-style-type: none"> <li>i. Check circuit board (340) by removing from box <i>without</i> disconnecting wires; see page 22 for removal procedure.</li> </ol> <p><b>WARNING:</b> Removing the circuit board while still wired over-rides the optical detector which could cause the sprayer to over-pressurize, if the microswitch does not function properly. Turn the sprayer on <b>ONLY</b> long enough to check lamp condition, then shut off immediately.</p> <p><b>WARNING:</b> To reduce the risk of electric shock, handle board by edges only! Do not allow any metal objects to come in contact with the board!</p> <p>Plug in and turn on sprayer. Clear lamp should be on now — removing the circuit board over-rides the optical detector. Turn <b>off</b> and unplug sprayer.</p> <ol style="list-style-type: none"> <li>2. Check bourdon tube flag and detector position. Reinstall circuit board (see page 22). Turn pressure setting to maximum; flag should extend <i>less</i> than half way into optical detector slot from the bonom.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace circuit board. See page 22</li> <li>2. Calibrate pressure control to see if that corrects problem. See page 24.</li> </ol> <p>If not, replace baro pressure control box (301)<sup>2</sup>. See page 23</p>

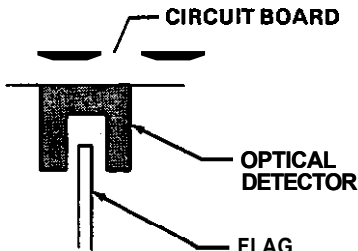
The diagram is a side-view cross-section of the sprayer's internal components. A vertical line points to a rectangular component labeled 'FLAG'. Below it, a horizontal line points to a slot labeled 'OPTICAL DETECTOR'. At the bottom, a horizontal line points to a rectangular component labeled 'CIRCUIT BOARD'. The flag is positioned above the optical detector slot, and the circuit board is below it.

VIEW OF OPTICAL DETECTOR AND FLAG

**\*When replacing the bare pressure control box (301), remove the ON/OFF switch, bridge, circuit board and electrical hardware and reinstall in the new bare box.**

**Troubleshooting continued on next page.**

TYPE OF PROBLEM	WHAT TO CHECK If check is <b>OK</b> , go to next check	WHAT TO DO If check is <b>NOT OK</b> refer to this column
<p>LOW OUTPUT</p>	<ol style="list-style-type: none"> <li>1. Check for worn spray tip.</li> <li>2. Check to see that pump does not continue to stroke when gun trigger is released. Plug in and turn on sprayer. Prime with paint. Trigger gun momentarily, then release and engage safety latch. Relieve pressure, turn off and unplug sprayer.</li> <li>3. Check electrical supply with volt meter. Meter should read <b>190-250 Volts</b>.</li> <li>4. Check extension cord size and length; must be at least 12 gauge wire and no longer than 15.2 m (150 ft).</li> <li>5. Check G1 and G2 leads from bridge (308) to circuit board (340) for damage or loose wires or connectors. Refer to page 22</li> <li>6. Check stall pressure. Refer to Calibration Procedure on page 24.</li> <li>7. Check bridge (308) + and - leads and terminals to motor. Inspect wiring insulation and terminals for signs of overheating. See page 20.</li> <li>8. Check for loose motor brush leads and terminals. See page 27.</li> <li>9. Check for worn motor brushes which should be 14 mm (9/16") minimum. See page 27.</li> <li>10. Check for broken and misaligned motor brush springs. Rolled portion of spring must rest squarely on top of brush.</li> <li>11. Check motor brushes for binding in brush holders. See page 27.</li> <li>12. Check circuit board (340) by substituting with a good circuit board. See page 22</li> <li>13. Check motor armature for shorts by using an armature tester (growler) or perform spin test. See page 15.</li> <li>14. Check bridge (308) by substituting with a good bridge or by performing the bridge test. See page 16 or 20. CAUTION: Do not perform this check until armature is determined to be good. A bad armature will immediately burn out a good bridge.</li> </ol>	<ol style="list-style-type: none"> <li>1. Follow Pressure Relief Procedure Warning then replace tip. See your separate gun or tip manual.</li> <li>2. Service pump. See manual 307-793.</li> <li>3. Reset building circuit breaker; replace building fuse. Repair electrical outlet or try another outlet.</li> <li>4. Replace with a correct, grounded extension cord.</li> <li>5. Clean circuit board male terminals. Replace loose or defective lead terminals. Securely reconnect lead terminals to board.</li> <li>6. Calibrate pressure control. See page 24.</li> <li>7. Be sure male terminal blades are centered and firmly connected to female terminals. Replace any loose terminal or damaged wiring. Securely reconnect wires to bridge.</li> <li>8. Tighten terminal screws. Replace brushes if leads are damaged. See page 27.</li> <li>9. Replace brushes. See page 27.</li> <li>10. Replace spring if broken. Realign spring with brush. See page 27.</li> <li>11. Clean brush holders, remove carbon dust with small cleaning brush. Align brush lead with slot in brush holder to assure free vertical brush movement.</li> <li>12. Replace circuit board. See page 22</li> <li>13. Replace motor. See page 29.</li> <li>14. Replace bridge. See page 20.</li> </ol>
<p>NO OUTPUT</p> <p>Motor runs and pump stroke:</p>	<ol style="list-style-type: none"> <li>1. Check paint supply.</li> <li>2. Check for clogged intake strainer.</li> <li>3. Check for loose suction tube or fittings.</li> </ol>	<ol style="list-style-type: none"> <li>1. Refill and reprime pump.</li> <li>2. Remove and clean, then reinstall.</li> <li>3. Tighten; use thread sealant or sealing tape on threads if necessary.</li> </ol>

TYPE OF PROBLEM	WHAT TO CHECK If check is OK, go to next check	WHAT TO DO If check is NOT OK refer to this column
<b>NO OUTPUT</b> (Continued)	<ol style="list-style-type: none"> <li>Check to see if intake valve ball and piston ball are seating properly. See manual 307-793.</li> <li>Check for leaking around throat packing nut which may indicate worn or damaged packings. See manual 307-793.</li> </ol>	<ol style="list-style-type: none"> <li>Remove intake valve and clean. Check balls and seats for nicks; replace if necessary. See manual 307-793.</li> <li>Replace packings. See manual 307-793. Also check piston valve seat for hardened paint or nicks and replace if necessary.</li> </ol>
Motor runs but pump does not stroke	<ol style="list-style-type: none"> <li>Check displacement pump connecting rod pin. See page 26.</li> <li>Check connecting rod assembly for damage. See page 25.</li> <li>Be sure crank in drive housing rotates; plug in sprayer and turn on momentarily to check. Turn off and unplug sprayer. See page 25.</li> </ol>	<ol style="list-style-type: none"> <li>Replace pin if missing. Be sure retainer spring is fully in groove all around connecting rod. See page 26.</li> <li>Replace connecting rod assembly. See page 25.</li> <li>Check drive housing assembly for damage and replace if necessary. See page 25.</li> </ol>
<b>EXCESSIVE PRESSURE FLUCTUATIONS</b>  Spray pattern variations.	<ol style="list-style-type: none"> <li>Be sure both G1 and G2 leads from bridge (308) to circuit board (340) are firmly connected. See page 22.</li> <li>Check stall pressure. Refer to Calibration procedure on page 24.</li> <li>Check bourdon tube flag and detector position. Turn pressure sensing to maximum; flag should not drag or bind in optical detector slot of circuit board.</li> </ol>  <p>VIEW OF OPTICAL DETECTOR AND FLAG*</p> <ol style="list-style-type: none"> <li>Check circuit board (340) by substituting with a good board. See page 22.</li> <li>Check <b>LOW OUTPUT</b> section on page 12.</li> </ol>	<ol style="list-style-type: none"> <li>Reconnect securely. See page 22.</li> <li>Calibrate pressure control. See page 24.</li> <li>Carefully bend flag into alignment with detector slot to see if that corrects problem. If not, replace bare pressure control assembly (301)*. Calibrate pressure control after reassembly.</li> <li>Replace circuit board. See page 22.</li> </ol>
<b>MOTOR IS HOT &amp; RUNS INTERMITTENTLY</b>	<ol style="list-style-type: none"> <li>Check to see if sprayer has been operating at high pressure with small tips, which causes low motor RPM and results in excessive heat build up.</li> <li>Check to see if ambient temperature where sprayer is located is more than 32°C (90°F) or if sprayer is located in direct sun.</li> <li>Check to see if sprayer has been left in a stalled condition (sprayer turned on, pressurized, but not operating) for long periods of time.</li> </ol>	<ol style="list-style-type: none"> <li>Decrease pressure sensing or increase tip size.</li> <li>Move sprayer to shaded, cooler area if possible.</li> <li>Turn off sprayer whenever you stop spraying for awhile and relieve fluid pressure.</li> </ol>

\*When replacing the bare pressure control box (301), remove the ON/OFF switch, bridge, circuit board, and electrical hardware and reinstall in the new bare box.

TYPE OF PROBLEM	WHAT TO CHECK If check <del>is</del> OK, go to next check	WHAT TO DO If check <del>is</del> NOT OK refer to this column
<p><b>ELECTRICAL SHORT</b></p> <p>Building circuit breaker opens as soon as sprayer switch is turned on.</p> <p><b>CAUTION</b> Any short in any part of the motor power circuit, which is connected to the output side of the bridge, will cause the bridge to burn out immediately. Correctly diagnose and repair all shorts before checking and replacing bridge.</p>	<p>Check all electrical wiring for damaged insulation, and all terminals for loose fit or damage. Be sure to check wires between pressure control and motor which are encased in conduit (41). See page 29.</p> <p>Check for missing inspection plate gasket (see page 27), bent terminal forks or other metal to metal contact points which could cause a short.</p> <p>Check motor armature for shorts by using an armature tester (growler) or perform spin test. See page 15. Inspect windings for bums.</p> <p>Check bridge (308) by substituting with a good bridge or by performing bridge test. See page 16.</p> <p><b>CAUTION:</b> Do not perform this check until armature is determined to be good. A bad armature will immediately burn out a good bridge.</p>	<ol style="list-style-type: none"> <li>1. Repair or replace any damaged wiring or terminals. Securely reconnect all wires.</li> <li>2. Correct faulty conditions.</li> <li>3. Replace motor. See page 29.</li> <li>4. Replace bridge. See page 20.</li> </ol>
<p>Building circuit breaker opens as soon as sprayer is plugged into outlet and sprayer is NOT turned on.</p>	<p>Check 'Basic Electrical Problems' on page 9.</p> <p>Check ON/OFF switch (302) See page 19. <b>Be sure the sprayer is unplugged!</b> Disconnect wires from switch and check switch with ohm meter. The ohm meter should read infinity with the ON/OFF switch OFF, and zero with the switch ON.</p> <p><b>CAUTION:</b> A short in the motor circuit will burn the bridge out immediately, which in turn usually causes the ON/OFF switch to fail in the closed mode.</p>	<ol style="list-style-type: none"> <li>2. Replace ON/OFF switch. See page 19.</li> </ol>

## SPIN TEST

## -WARNING

Before doing this procedure, follow the Pressure Relief Procedure Warning on page 17 to reduce the risk of a fluid injection injury, splashing fluids in the eyes or on the skin, injury from moving Darts, or electric shock.

For checking armature, motor winding and brush electrical continuity.

## Setup

Remove the drive housing from the sprayer as described in Steps **1-9**, page **25**.

Remove the pressure control cover and screws, the motor cover, the fan cover (F), and the inspection covers (J). See Fig 9.

Disconnect the **two** leads from the motor to the bridge (308). See Fig 10.

### Armature **Short** Circuit Test

Quickly turn the motor fan by hand. **If there are no shorts**, the motor will coast two or three revolutions before coming to a complete stop.

If the motor does not spin freely and resists rotation, the armature is shorted and the motor must be replaced. See page **29**.

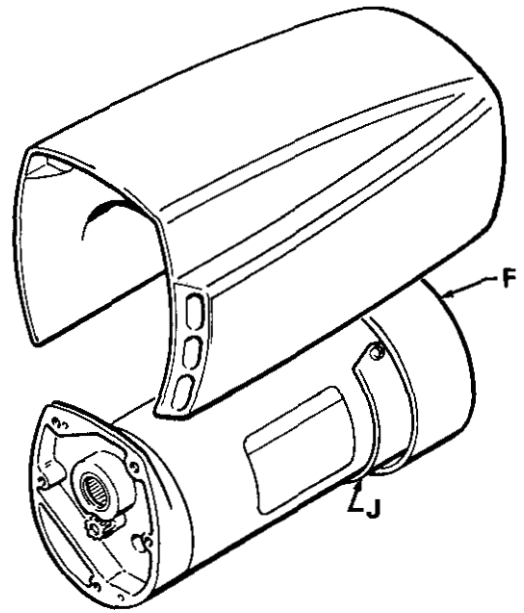
## Armature, Brushes, and Motor Wiring Open Circuit Test (Continuity)

Connect the two black motor leads together with a test lead.

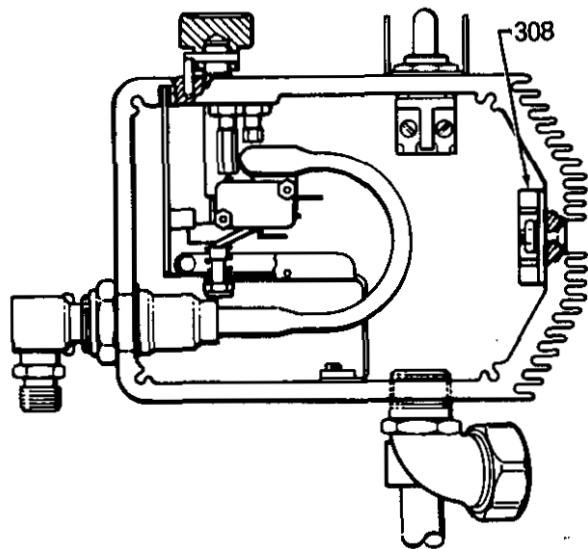
Turn the motor fan by hand at about two revolutions per second.

If there is uneven or no turning resistance, check the following: a) broken brush springs; b) broken brush leads; c) loose brush terminal screws; d) worn brushes; e) broken motor leads; f) **loose** motor lead terminals. Repair parts as needed. See page 27.

If there is still uneven or no turning resistance, replace the motor. See page 29.



**Fig 9**



**Fig 10.**



BRIDGE TEST

Remove the bridge from the pressure control box and perform this test to determine if the bridge is functional. See Bridge Rectifier Replacement, page 20. Use a continuity tester, such as multi-meter set on the X1 ohms scale ( **Ω** ).

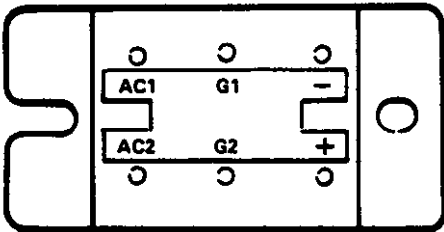
Eight individual checks, or tests, must be performed. If the bridge fails even one test, it must be replaced.

Fig 11 shows the position of the wires on the bridge. Using the chart at the right, connect the meter wires as indicated by the black dots for each test, then check the continuity.

In Tests 1, 2 and 3, there should be NO continuity.

In Tests 4, 5 and 6, connect the + and - meter wires as indicated, check continuity, then switch the meter wire connections and check continuity again. You should get NO continuity one way, and YES continuity the other way.

In Tests 7 and 8, connect the meter wires as indicated by the black dots. Touch the indicated "G" wire to one meter wire, and then the other. You should get NO continuity one way, and YES continuity the other way.











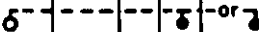

		BRIDGE WIRES						
		G2	G1	-	+	AC1	AC2	
CONTINUITY	NO					•	•	TEST 1
	NO				•		•	TEST 2
	NO				•	•		TEST 3
	YES							TEST 4
	NO							
	YES							TEST 5
	NO							
	YES							TEST 6
NO								
YES							TEST 7	
NO								
YES							TEST 8	
NO								

Fig 11

## WARNING

### Pressure Relief Procedure

To reduce the risk of serious bodily injury, including fluid injection, splashing fluid in the eyes or on the skin, or injury from moving parts or electric shock, always follow this procedure whenever you shut off the sprayer, when checking or servicing any part of the spray system, when installing, cleaning or changing spray tips, and whenever you stop spraying.

1. Engage the gun safety latch.
2. Turn the ON/OFF switch to OFF.
3. Unplug the power supply cord.
4. Disengage the gun safety latch.
5. Hold a metal part of the gun firmly to the side of a grounded metal pail, and trigger the gun to relieve pressure.
6. Engage the gun safety latch.
7. Open the drain valve, having a container ready to catch the drainage.
8. Leave the drain valve open until you are ready to spray again.

If you suspect that the spray tip or hose is completely clogged, or that pressure has not been fully relieved after following the steps above, VERY SLOWLY loosen the tip guard retaining nut or hose end coupling and relieve pressure gradually, then loosen completely. Now clear the tip or hose.

### Tool List

The following tools are needed when repairing this sprayer.

Phillips screwdriver  
Small flatblade screwdriver  
Needle nose pliers  
Plastic mallet  
Adjustable wrench  
2" adjustable, open-end wrench  
Torque wrench  
1/4" hex key wrench  
3/16" hex key wrench  
5/8" socket wrench  
3/8" open end wrench  
1/2" open end wrench  
3/4" open end wrench  
7/8" open end wrench  
High quality motor oil  
Bearing grease

For calibration procedure only:

3/8" ignition wrench  
0.015" spray tip  
High pressure, oil-filled test gauge, Part No. 102-814  
5 gallon pail  
Clean water  
Mineral spirits  
NEW 207 bar (3000 psi) high pressure spray hose, Part No. 214-915.

Before repairing any part of the sprayer, read the following general repair notes and the repair procedure. Be sure you have the necessary tools and parts available.

1. When disconnecting wires in the pressure control assembly, use needle nose pliers to separate mating connectors.

When reconnecting the wires, be sure the flat blade of the insulated male connector is centered in the wrap-around blade of the female connector when the connection is made.

## CAUTION

To reduce the risk of a pressure control malfunction, be sure to properly mate connectors, and never pull on a wire to disconnect it. Pulling on a wire could loosen the connector from the wire.

2. Route wires in the pressure control assembly carefully through the legs of the U-shaped bourdon tube, where appropriate, to avoid interfering with the bourdon tube which moves as the pressure setting changes and to avoid pinching the wires between the pressure control box and cover.

## CAUTION

Improper wire routing can result in poor sprayer performance or damage to the pressure control.

3. Keep all screws, nuts, washers, gaskets, and electrical fittings removed during repair procedures. These parts are not normally provided with replacement assemblies.
4. Test your repair before regular operation of the sprayer to be sure the problem is corrected.

If the sprayer does not operate properly, review the repair procedure again to verify that everything was done correctly. If necessary, refer to the Troubleshooting Guide, pages 9-16, to help identify other possible problems and solutions.

## WARNING

To reduce the risk of serious bodily injury, including electric shock, DO NOT touch any moving parts or electrical parts with your fingers or a tool while inspecting the repair.

Shut off the sprayer and unplug it as soon as you complete the inspection.

Reinstall all covers, gaskets, screws and washers before operating the sprayer.

## CAUTION

Do not run the sprayer dry for more than 30 seconds to avoid damaging the pump packings.

5. Reinstall the motor cover before regular operation of the sprayer and replace it if it is damaged. The cover directs cooling air around the motor to help prevent overheating. It can also help prevent burns, fire or explosion; see the WARNING, below.

## WARNING

During operation, the motor becomes very hot and could burn your skin if touched. Flammable materials spilled on the hot, bare motor could cause a fire or explosion. Always have the motor cover in place during regular operation to reduce the risk of burns, fire or explosion.

## POWER SUPPLY CORD REPLACEMENT (See Fig 12 & 13)

### WARNING

Before doing this procedure, follow the Pressure Relief Procedure Warning on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts, or electric shock.

1. Use the 19 mm open end wrench to remove the nut (337) from the filter stud (310).
2. Use the 13 mm socket wrench to remove the two screws (65) holding the pressure control to the frame.
3. Remove the pressure control mounting bracket (50) using a Phillips screwdriver.
4. Disconnect the power supply cord wires from the control box terminal strip (336) using a screwdriver.
5. Install the new power supply cord (311) in the reverse order of disassembly.

Install a new plug on the other end of the cord. Be sure to follow all local codes regarding the type of plug to use.

## FILTER REPLACEMENT (See Fig 12)

### WARNING

Before doing this procedure, follow the Pressure Relief Procedure Warning on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts, or electric shock.

1. Remove the pressure control cover and screws.
2. Use a needle nose pliers to remove the four wires from the filter (310).
3. Use the M8 wrench to remove the lower nut and lockwashers (337, 338) on the outside of the pressure control box.
4. Remove the old filter and install a new one in the reverse order of disassembly.

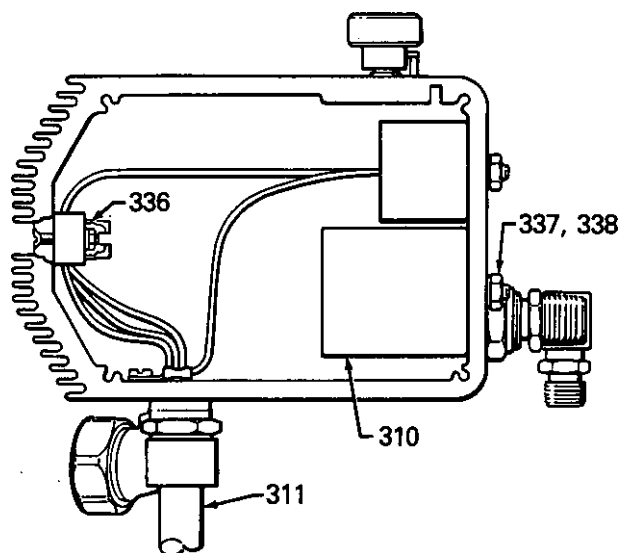


Fig 12

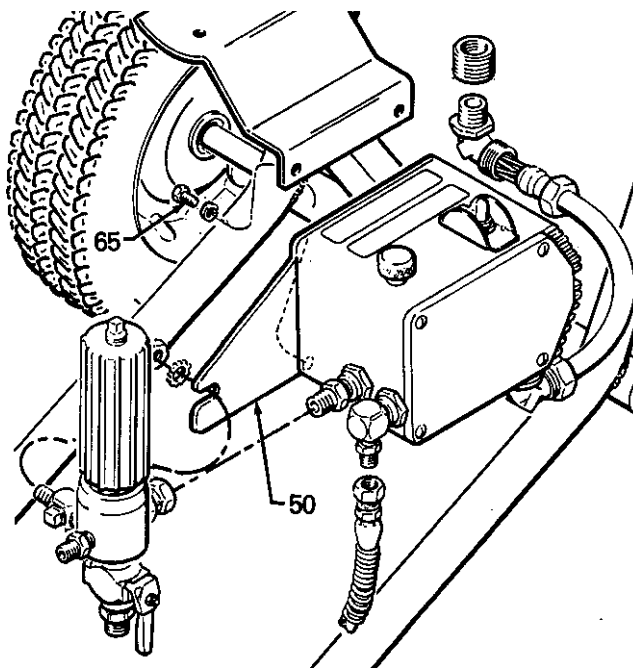


Fig 13

## ON/OFF SWITCH REPLACEMENT (See Figs 14 & 15)

### WARNING

Before doing this procedure, follow the Pressure Relief Procedure Warning on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts, or electric shock.

1. Remove the pressure control cover and screws.
2. Remove the wires attached to the switch (302) at TP1 and TP2, using a screwdriver. See page 22, Fig 21.
3. Use a 16 mm socket wrench to loosen and remove the nut and rubber boot (303) from the top of the pressure control box. Remove the switch guard (304).
4. Remove the ON/OFF switch.
5. Remove the wires attached to the switch TP4 and TP3 using a screwdriver. See page 22, Fig 21.
6. Attach the wires to TP4 and TP3 of the new switch.
7. Install the new switch so the internal tab of the anti-rotation ring (W) engages with the vertical groove in the threads of the switch, and the external tab engages with the blind hole (D) of the pressure control box.
8. Install the switch guard (304), aligning the internal tab with the groove in the threads.
9. Powder the inside of the rubber boot (303) with talcum, then shake excess out of boot.
10. Install the nut and rubber boot and tighten.
11. Reconnect the wires to TP1 and TP2.
12. Reinstall the pressure control cover and screws.

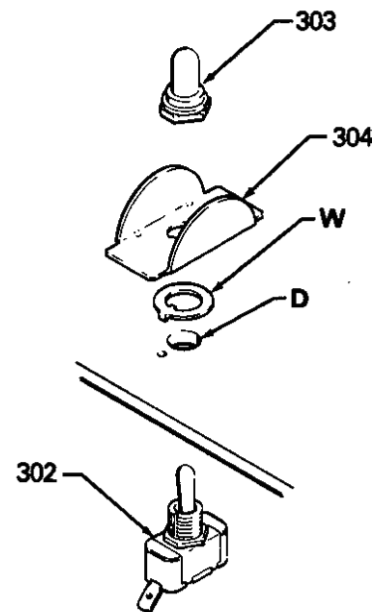


Fig 14

## MICROSWITCH REPLACEMENT (See Fig 15)

### WARNING

Before doing this procedure, follow the Pressure Relief Procedure Warning on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts, or electric shock.

1. Remove the pressure control cover and screws.
2. Disconnect both wires from the microswitch (306).
3. Use the socket wrench to remove the nuts from the microswitch.
4. Check to see if the flag (X) is loose. If it is, be sure the fluid pressure is 0 bar (0 psi), then loosen the two 6 mm hex nuts behind the microswitch. Adjust the distance from the top of the flat to top inside of the pressure control box to  $40.79 \pm 0.254$  mm ( $1.606 \pm 0.010$  in.). Tighten the screws and recheck the dimension. Refer to Fig 1.
5. Perform the **STALL PRESSURE CALIBRATION** on page 24 before regular operation of the sprayer.
6. Reinstall the cover and screws.

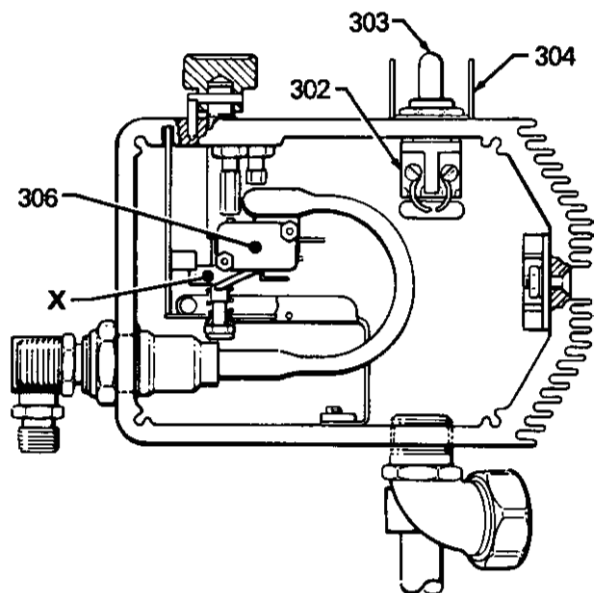


Fig 15

## BRIDGE RECTIFIER REPLACEMENT (See Fig 16)

### WARNING

Before doing this procedure, follow the Pressure Relief Procedure Warning on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts or electric shock.

1. Remove the pressure control cover and screws.
2. Disconnect all wires from the bridge (308) at the appropriate terminals.
3. Outside the pressure control box on the right side are **two** screws (331). **Loosen**, but don't remove the screw near the back mounting plate (50). Then loosen and remove the front screw. Slide the bridge out.
4. Slide the new bridge (308) into the box being sure the lockwasher (333) on the rear screw (331) is **IN FRONT** of the bridge. Refer to the Detail in Fig 16.
5. Install the front screw, lockwasher and nut (332).

### CAUTION

The lockwashers (333) must be in front of the bridge to avoid overheating which will result in bridge failure. Refer to the Detail in Fig 16.

6. Make sure the bridge is flush with the side of the box and tighten the screws securely.
7. Connect all wires. Carefully route the wires.

### CAUTION

Be sure the flat blade of the insulated male connector is centered in the wrap-around blade of the female connector when the connections are made. Improper connections may cause the sprayer to malfunction.

Route all wires carefully to avoid interference with the movement of the bourdon tube, circuit board, or control box cover which could cause a malfunction.

8. Reinstall the pressure control cover and screws.

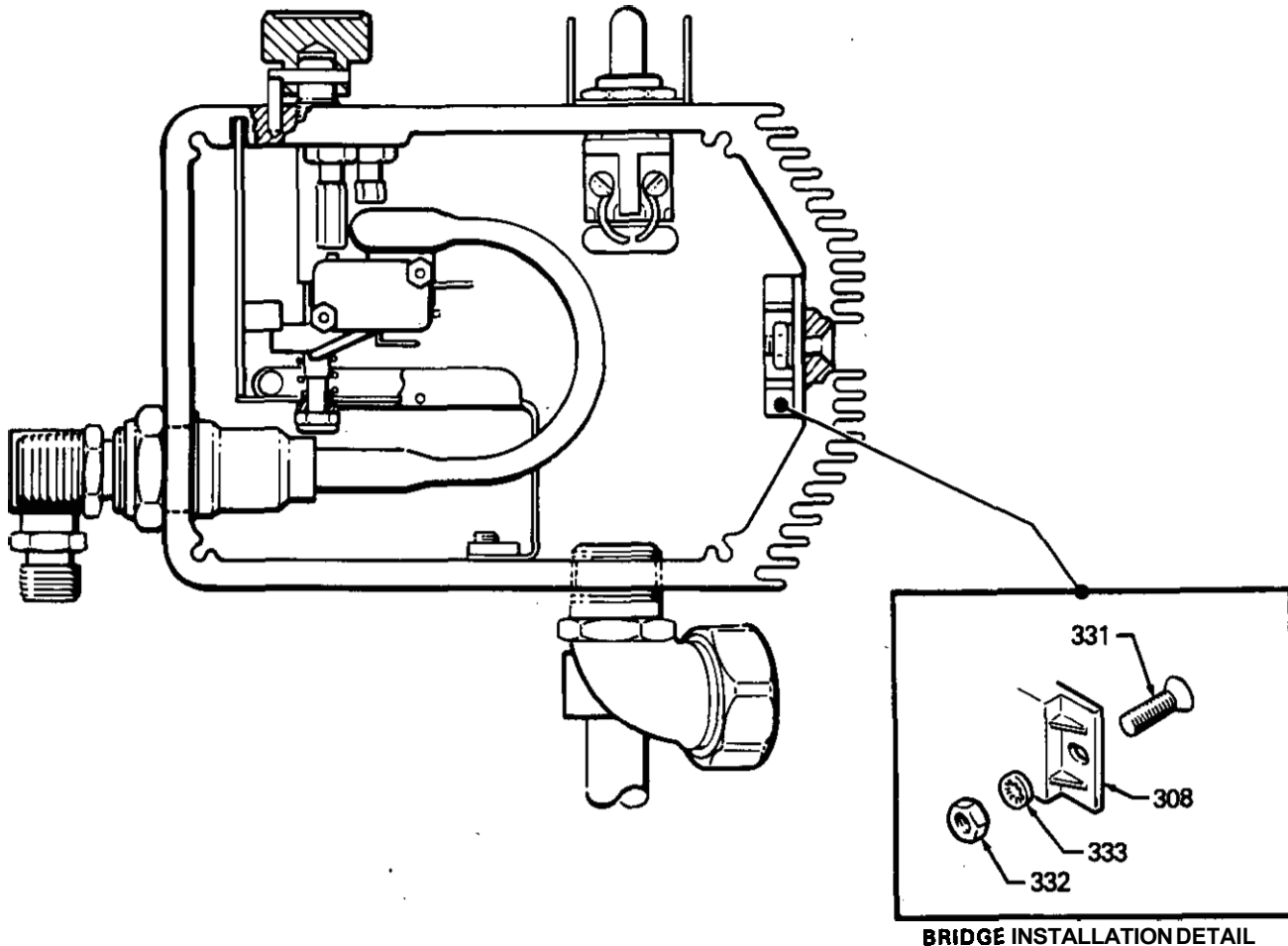


Fig 16

## CHOKE REPLACEMENT (See Fig 17)

### WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts, or electric shock. *Be sure to unplug the sprayer!*

1. Remove the pressure control cover and screws.
2. Remove the grounding screw (312) and remove the lead. Loosen the appropriate screw on the terminal strip (336) and disconnect the yellow/green choke lead.
3. Use the M8 wrench to remove the upper nut and lockwasher (337, 338) on the outside of the pressure control box.
4. Remove the old choke (309) and install a new one in the reverse order of disassembly.

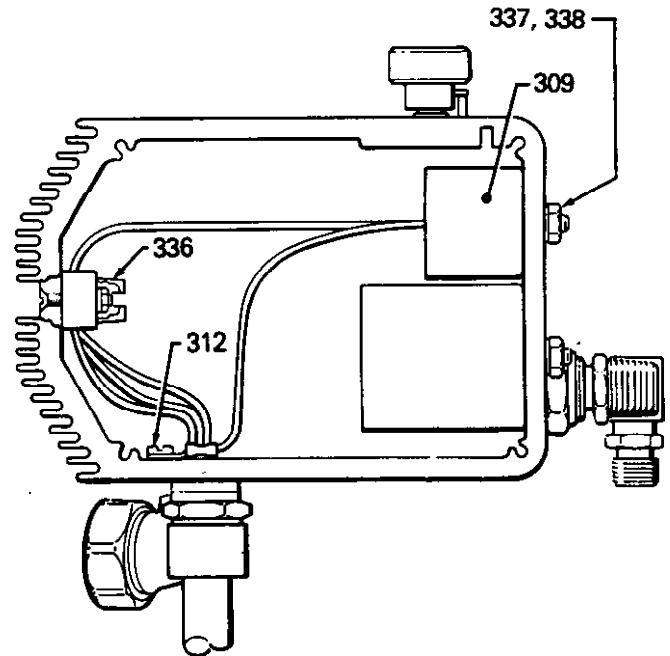


Fig 17

## VARISTOR REPLACEMENT (See Figs 18 & 19)

### WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts, or electric shock.

1. Remove the control box screws and cover.
2. Remove the two screws (A,B), the wiring harnesses (318, 319) and the old varistor from the ON/OFF switch (302).
3. Trim the leads on the new varistor (339) to 28.5 mm (1-1/8 in.). Turn each lead outward to form a loop that is large enough for the screws (A, B) to pass through.
4. Place a wiring harness on each screw, then place a loop of the varistor leads on each screw and thread the screws into the switch.
5. Wrap the varistor under the switch.

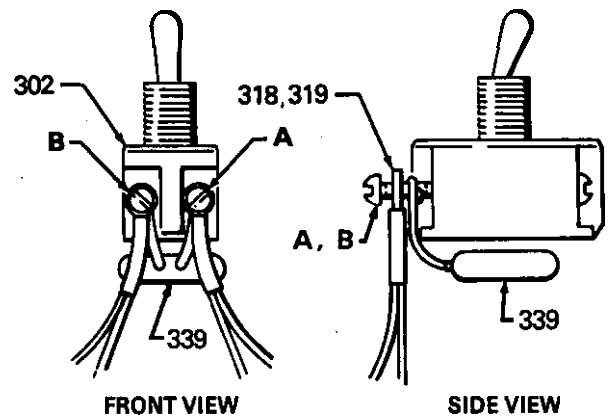


Fig 18

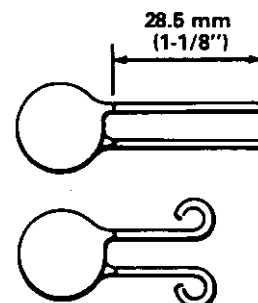


Fig 19

## CIRCUIT BOARD REPLACEMENT (See Figs 20 & 21)

### WARNING

Before doing this procedure, follow the Pressure Relief Procedure Warning on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts, or electric shock. **Be sure to unplug the sprayer!**

1. Remove the pressure control cover and screws.
2. Turn the pressure control knob all the way counter-clockwise to the minimum setting to release spring tension on the board. **Also** check to be sure only three or four threads of the pressure control knob shaft are exposed below the pressure adjustment nut (S). Back down the nut, if necessary. See Fig 20.

### CAUTION

**Step 2 is essential to reduce the risk of damaging the circuit board while removing or installing it.**

3. Disconnect **ALL** wires from the board, including the **two** heavy black wires. Pay close attention to where connections are made. See Fig 21.
4. To remove the board from the box, pull out the black plastic-tipped pin (330). Push the **bottom** of the circuit board toward the wall of the box and carefully slide the board out.
5. Install the board in the box at the Same angle as it was removed.
6. Reconnect all wires. Refer to the wiring diagram in Fig 21.

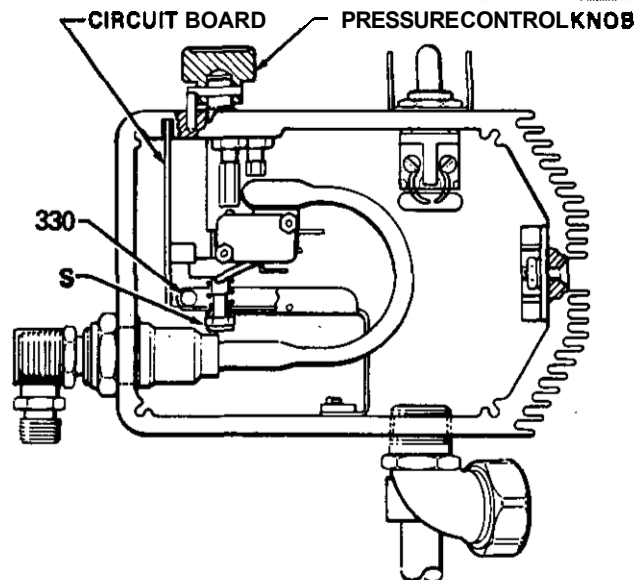


Fig 20

### CAUTION

Be sure the flat blade of the insulated male connector is centered exactly in the wrap-around blade of the female connector when connections are made.

Route all wires carefully to avoid interference with the circuit board, bourdon tube and pressure control cover.

These precautions are essential to reduce the risk of malfunction.

7. Perform the **STALL PRESSURE CALIBRATION** on page 24 if you installed a new board.

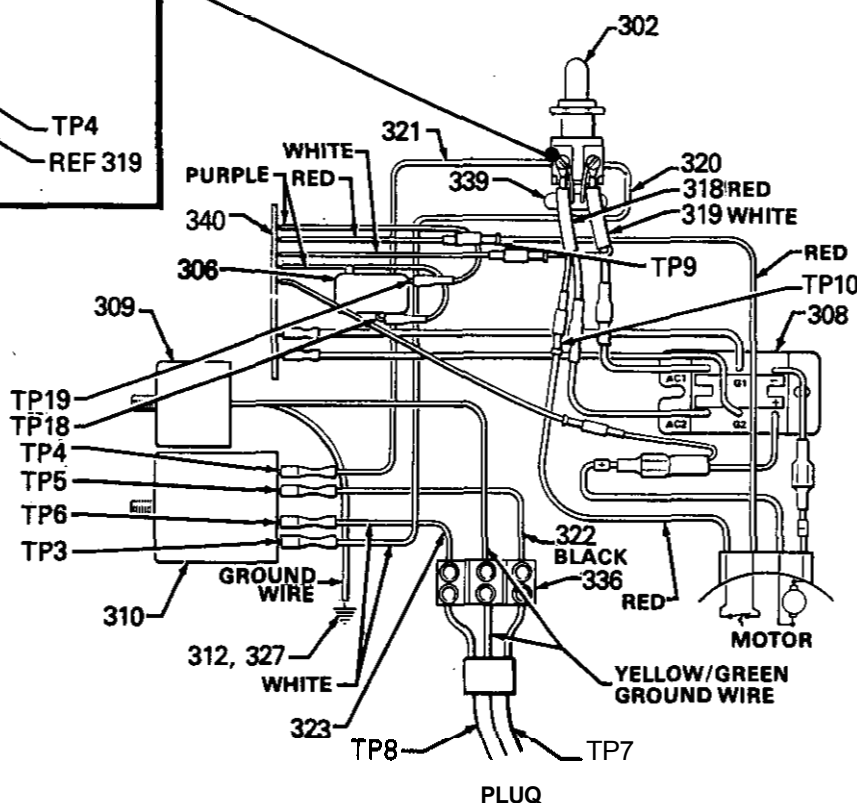
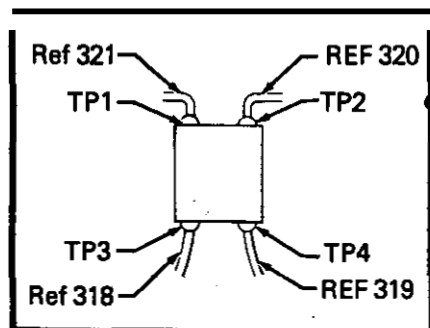


Fig 21

## **WARNING**

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts, or electric shock. *Be sure to unplug the sprayer!*

1. Disconnect the main fluid hose (72) and the secondary fluid hose, if used, from the sprayer.
2. Disconnect the fluid hose (23) from between the displacement pump outlet nipple (22) and pressure control inlet elbow (314).
3. Loosen the filter bracket nut (63) and washer (62) using a 19 mm open end wrench.
4. Hold the pressure control adapter (315) firmly with a 19 mm open end wrench. Use an adjustable wrench to loosen the swivel union (52), then remove the fluid filter (53).
5. Remove the pressure control cover and screws, and disconnect the four motor leads at the appropriate terminals.
6. Refer to **CIRCUIT BOARD REPLACEMENT** on page 22, remove the circuit board and retain.
7. Remove the conduit (41).
8. Use a 13 mm open end wrench to loosen and remove the pressure control mounting screws (65) and washers (64) located below the pressure control box. Remove the box.
9. Install the new pressure control assembly in the reverse order of disassembly.

## **CAUTION**

Do not allow the adapter (315) to turn while installing the new pressure control assembly. Turning it can damage the sensitive bourdon tube. Hold the adapter firmly with a 19 mm open end wrench while screwing on the swivel union (52).

10. Perform the **STALL PRESSURE CALIBRATION** starting on page 24, before regular operation of the sprayer.

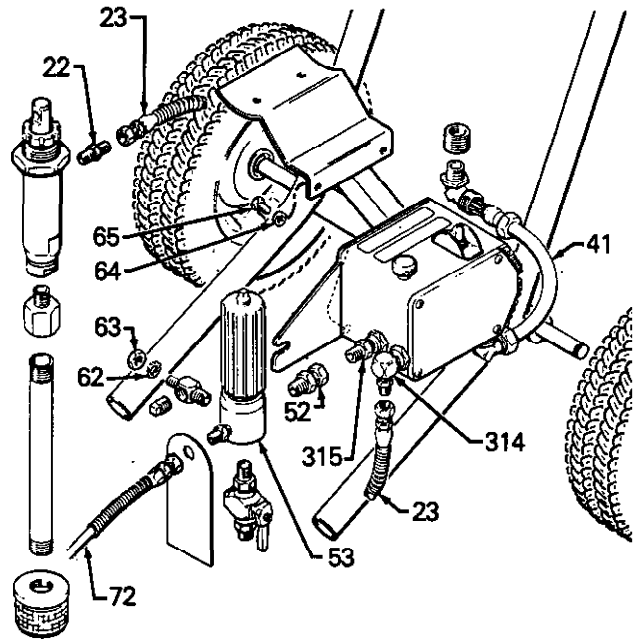


Fig 22



## WARNING

**USE EXTREME CAUTION WHEN PERFORMING THIS CALIBRATION PROCEDURE** to reduce the risk of a fluid injection injury or other serious bodily injury which can result from splashing, component rupture, electric shock, fire, explosion, or moving parts.

This procedure sets the sprayer to 192 bar (2750 psi) **MAXIMUM WORKING PRESSURE**. This procedure must be performed whenever a **new** or used circuit board, or pressure control assembly is removed and reinstalled or replaced, to be sure the sprayer is properly calibrated.

Improper calibration can cause the sprayer to over-pressurize and result in component rupture, fire or explosion. It may also prevent the sprayer from obtaining the maximum working pressure which would result in poor sprayer performance.

**NEVER** attempt to increase the fluid outlet pressure by performing this calibration in any other way. **NEVER EXCEED 192 bar (2750 psi) MAXIMUM WORKING PRESSURE**. Normal operation of the sprayer at higher pressures could result in component rupture, fire or explosion.

**AVOID** touching the wires in the pressure control assembly with your fingers or **tools** when the control box cover is removed to reduce the risk of electric shock.

### Calibration Setup (See Fig 23 and 24)

1. Follow the Pressure Relief Procedure Warning on page 17. Remove the spray hose and gun. Install a 0.015" spray tip in the gun. Connect the gun to a **new** test hose and connect the hose to the sprayer outlet.
2. Remove the pressure control screws and cover.
3. Remove the plug from the top of the fluid filter, and install the test gauge (W).
4. Place the pump suction tube in a 5 gallon pail of clean water.
5. Be sure the gun safety latch is engaged.
6. Use a 9 mm (3/8") ignition wrench to turn the pressure adjustment nut (S) counterclockwise about **two** full turns. See Fig 24.
7. With the pressure control knob (B) at the **minimum** setting, turn the sprayer switch ON.

THE SPRAYER SHOULD NOT START!

**If it does start**, shut the sprayer switch OFF, disengage the gun safety latch, trigger the gun into a grounded waste container until pressure is relieved. Engage the gun safety latch. Turn the pressure adjustment nut (S) a little further counterclockwise. Turn the sprayer on to be sure it **does not** start.

8. **Slowly** turn the pressure control knob (B) clockwise to the maximum setting and hold it there. Use a 9 mm (3/8") ignition wrench to slowly turn the pressure adjustment nut (S) clockwise **until** the test gauge reads **EXACTLY 192 bar (2750 psi)**.

### WARNING

Follow the Pressure Relief Procedure Warning on page 17.

### CAUTION

**To prevent pump corrosion**, flush the water out of the pump, hose and gun with mineral spirits. Be sure to close the drain valve, first. **Use** the lowest pressure necessary to flush. Follow the Pressure Relief Procedure Warning on page 17. Leave the mineral spirits in the pump to protect it until you are ready to spray again.

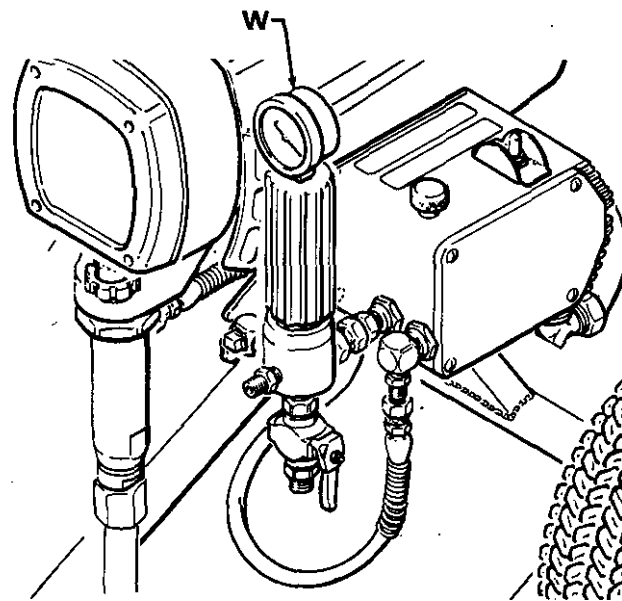


Fig 23

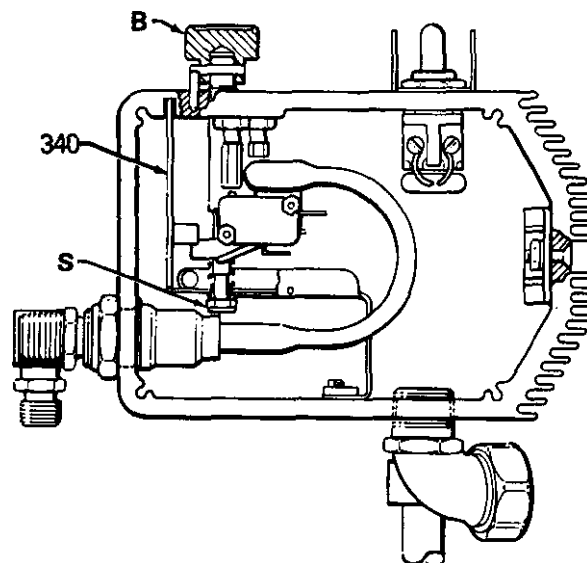


Fig 24

9. Remove the test gauge assembly and reinstall the plug. Flush out water with mineral spirits.

## CONNECTING ROD, DRIVE HOUSING, or CRANKSHAFT REPLACEMENT (See Fig 25)

### WARNING

Before doing this procedure, follow the Pressure Relief Procedure Warning on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts or electric shock. **Be sure to unplug the sprayer!**

**NOTE:** Stop the sprayer at the bottom of its stroke to get the crank (81) in its lowest position. If the crank must be lowered manually, carefully rotate the blades of the fan with a screwdriver.

1. Remove the front cover and screws (11, 13).
2. Unscrew the suction tube (14) from the pump, holding a wrench on the pump intake valve to keep the pump from loosening.
3. Disconnect the pump outlet hose (23) from the pump outlet nipple (22).
4. Use a screwdriver to push aside the retaining spring (21) at the top of the pump. Push the pin (20) out the rear.
5. Loosen the jam nut (86) with an adjustable wrench. Unscrew and remove the displacement pump (19).
6. Remove the connecting rod (9), inspect for wear or damage, and replace if needed.
7. Use a 5 mm (3/16") hex key wrench to remove the three screws and lockwashers (8, 7) from the recess of the drive housing (6).
8. Remove the four short screws (110) and two long screws (112) and spacers (111) from the motor shield (1). Remove the shield.
9. Use a 4 mm (5/32") hex key wrench to remove the two screws and lockwashers (78, 79) from the top rear of the front end bell (L).
10. Lightly tap the lower rear of the drive housing with a plastic mallet to loosen it from the motor front end bell. Then pull the housing off.

### CAUTION

**DO NOT** allow the gear cluster (26) to fall when removing the drive housing (6). It is *easily* damaged if dropped.

DO NOT lose the thrust balls (24) located at each end of the gear cluster (26) or allow them to fall between gears. The ball, which is heavily covered with grease, usually stays in the shaft recesses, but could be dislodged. If caught between gears and not removed, the balls will seriously damage the drive housing. If the balls are not in place, the bearings will wear prematurely.

11. Inspect the drive housing for wear or damage and replace if needed.
12. Pull the Crankshaft (81) out. Inspect for wear or damage and replace, if needed. Be sure the bearings (81a and 81b) are in place on either side of the crankshaft assembly.
13. Evenly lubricate the inside of the bronze bearing in the drive housing with high quality motor oil. Liberally pack the roller bearings and gears with bearing grease.
14. Install the crankshaft, meshing the gears.
15. Clean the mating surfaces of the drive housing and front end bell.
16. Carefully align the drive housing and front end bell with the locating pins, then push the drive housing onto the front end bell or tap it into place with a plastic mallet.
17. Reinstall the motor shield (1) using the two long screws (112) and spacers (111) and the four short screws (110).
18. Install the screws and lockwashers (8, 7) and tighten evenly.

### CAUTION

**DO NOT** use the drive housing screws to try to align or seat the housing, which would cause improper alignment and premature bearing wear.

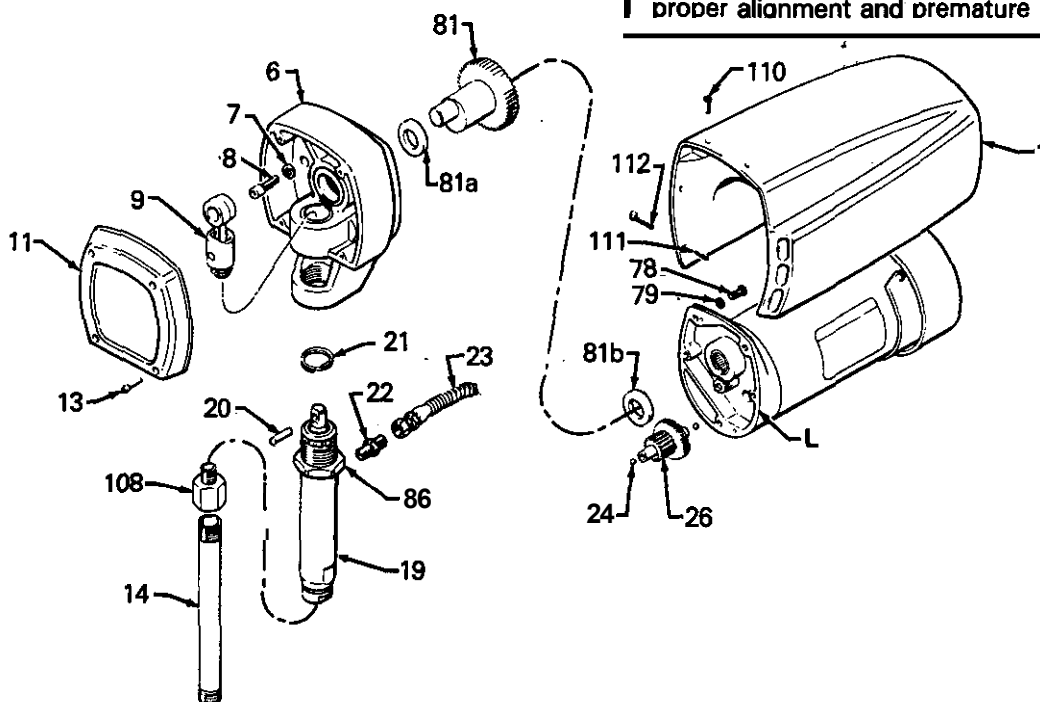


Fig 25

19. Install the connecting rod (9).
20. Screw the displacement pump about 3/4 of the way into the bearing housing (6). Hold the pin (20) up to the pin hole in the connecting rod assembly (9) and continue screwing in the pump until the pin slides easily into the hole. Back off the pump until the top threads of the pump cylinder are flush with the face of the bearing housing and the outlet nipple (22) is facing back. Push the retaining spring (21) into the groove all the way around the connecting rod. Tighten the jam nut (86) to 94 N·m (70 ft-lb) —very tight to prevent it from loosening which will damage the bearing housing. See Figures 25 and 26.

#### WARNING

**Be sure the retaining spring (21) is firmly in the groove of the connecting rod, all the way around, to prevent the pin (20) from working loose due to vibration. See Fig 26.**

If the pin works loose, it or other parts could break off due to the force of the pumping action. These parts could be projected through the air and result in serious bodily injury or property damage, including damage to the pump, connecting rod or bearing housing.

21. Reinstall the front cover and screws (11, 13). Reconnect the suction tube (14) and pump outlet hose (23).

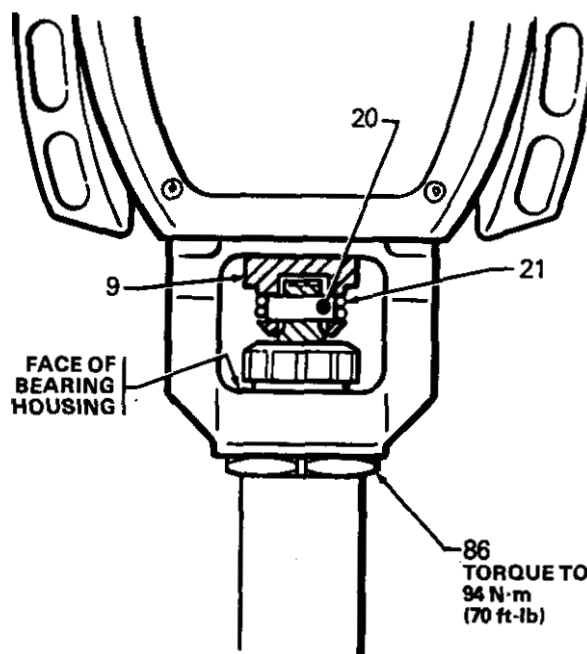


Fig 26

## MOTOR BRUSH REPLACEMENT (See Figs 27 & 28)

**NOTE:** New motor brushes are included with each Packing Repair Kit. Replace them when replacing the packings, and/or when they have been worn to a minimum of 9/16 on the longest side.

### WARNING

Before doing this procedure, follow the Pressure Relief Procedure Warning on page 17 to reduce the risk of fluid injection injury, splashing in the eyes or on the skin, injury from moving parts or electric shock. **Be sure to unplug the sprayer!**

1. Remove the four short screws (110) and the two long screws (112) and spacers (111) from the motor shield (1). Remove the shield. See Fig 27.
2. Remove the screws (H), inspection covers (J) and gaskets (K) on each side of the motor. See Fig 27.
3. **Loosen** the brush lead terminal screw and remove the lead.
4. Push down on the spring clip slightly then pull the clip away from and out of the brush holder. Refer to Fig 28. Keep the spring clip.
5. Remove and discard the brush.
6. Inspect the commutator for excessive pitting, burning or gouging.

**NOTE:** A black color on the commutator is normal.

Have the commutator resurfaced by a qualified motor repair shop if the brushes seem to be wearing too fast.

7. Place a new brush in the holder so the beveled edges are as shown in the first part of Fig 28, and the brush lead is routed as shown in the second part of Fig 28.
8. Slowly push the tabbed end of the spring clip into the brush holder until the clip tab engages in the holder and the rolled portion of the tension spring rests squarely on the brush.
9. Route the brush lead to the terminal and tighten the terminal screws. Be sure the brush lead does not touch any part of the armature or motor housing.
10. Test the brushes:
  - a. With the ON/OFF switch OFF, turn the pressure control knob all the way counterclockwise to minimum pressure. Plug in the sprayer.
  - b. Turn the ON/OFF switch ON and slowly increase the pressure until the motor comes up to full speed.
  - c. Inspect the brush and commutator contact area for excessive arcing. Arcs should not "trail" or circle around the commutator surface.

### WARNING

Do not touch the brushes, leads, springs or brush holders while the sprayer is plugged in to avoid electric shock and possible serious bodily injury.

### CAUTION

Do not run the sprayer dry for more than 30 seconds while checking the brushes to avoid damaging the displacement pump.

11. Reinstall the brush inspection covers, gaskets, and screws. Reinstall the motor shield and screws.

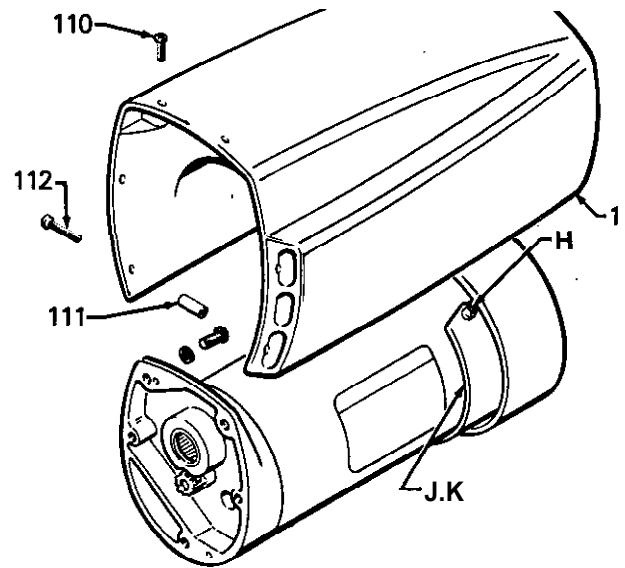
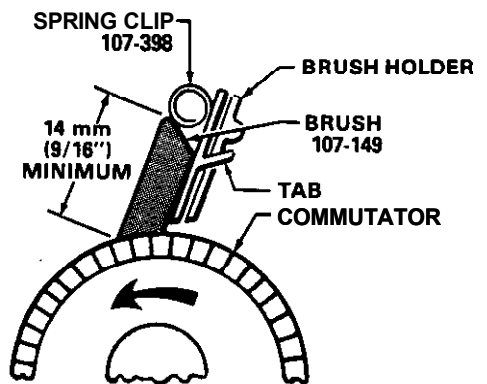
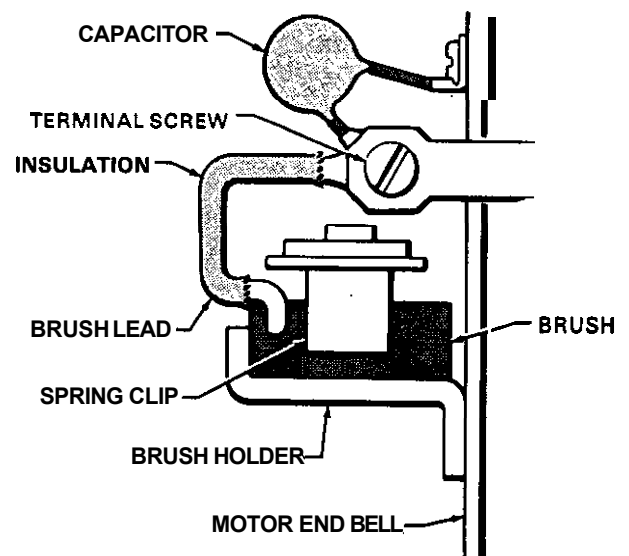


Fig 27



SIDEVIEW OF MOTOR BRUSH INSTALLATION



DETAIL OF MOTOR BRUSH SHOWN WITH MOTOR LEAD FACING BACK OF MOTOR

Fig 28

## MOTOR CAPACITOR REPLACEMENT (See Figs 29 & 30)

### WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts or electric shock. **Be sure to unplug the sprayer!**

1. Remove the control box cover (48). Disconnect the motor leads.
2. Remove the fan cover (F) and screws (G) from the rear of the motor. See Fig 29.
3. Use a screwdriver to **gently** lift the fan tab out of the motor shaft groove and remove the fan (E).
4. Remove the inspection cover (J), screws (H), and gasket (K) from each side of the motor (2). See Fig 29.
5. Push down slightly on the spring clip and pull the clip out of the brush holder. See Fig 30.
6. Gently push the brushes out of the brush holder and inspect. Replace if necessary. See page 27.
7. Make a matchmark between the front end bell (L) and the motor housing and the rear end bell (M) and the motor housing to use as alignment marks during reassembly. **Also** make a mark on the **front** of the motor housing. Refer to Fig 29.
8. Use a 11 mm (7/16") socket wrench to remove the nuts from the rear end bell (M).
9. Gently tap alternate ears of the rear end bell with a plastic mallet to loosen it, then pull it straight off. **Do not** pull the motor armature out. **Retain any washers that fall out when the bell is removed.**
10. To replace the capacitor, remove the brush lead terminal screws (Y) and the screw (Z) going into the insulation plate of the rear end bell. Install a new capacitor (X), making sure the ceramic case of the capacitor is not cracked. Maintain a 3 mm (1/8") clearance between the capacitor and any grounded metal parts. Always replace both capacitors at the same time.
11. Position the rear end bell (M) over the tie bolts and push it onto the motor housing. Align the matchmarks carefully and install the lockwashers and nuts.
12. Position the fan (E) over the motor shaft and push it into place, making sure the fan tabs engage in the motor shaft groove.
13. Install the fan cover and screws.
14. Reconnect the motor leads in the pressure control box and reinstall the conduit (41). Push conduit seal (105) into conduit elbow, around the motor lead. Reinstall the pressure control cover (48) and screws (51).

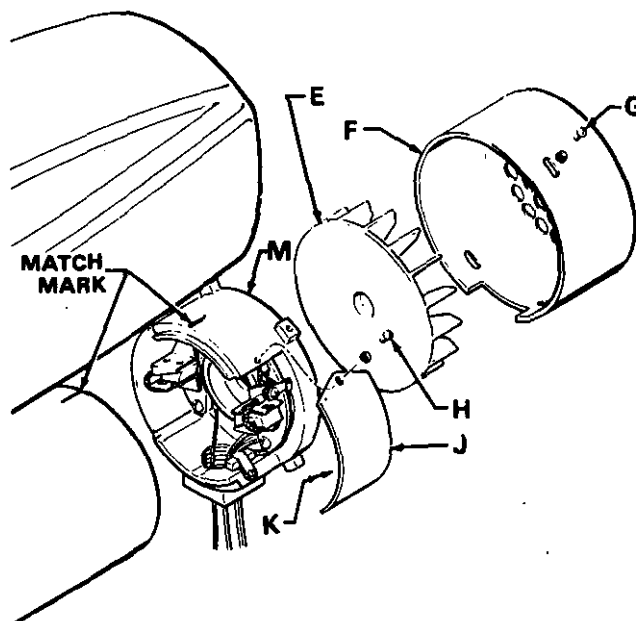
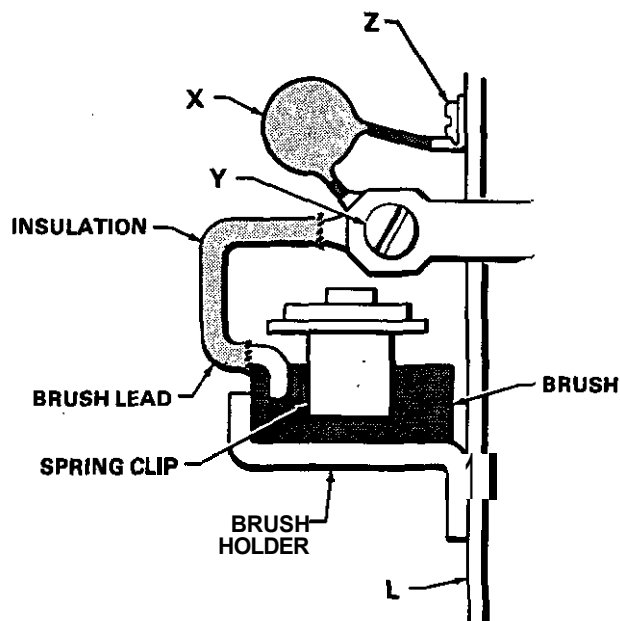


Fig 29



DETAIL OF MOTOR BRUSH  
SHOWN WITH MOTOR LEAD  
FACING BACK OF MOTOR

Fig 30

## WARNING

Before doing this procedure, follow the **Pressure Relief Procedure Warning** on page 17 to reduce the risk of a fluid injection injury, splashing in the eyes or on the skin, injury from moving parts, or electric shock. **Be sure to unplug the sprayer!**

1. Disconnect the pump outlet hose (23) from the displacement pump outlet nipple (22).
2. Remove the screws (51) and pressure control cover (48) and disconnect the four motor leads.
3. Use an adjustable wrench to loosen the conduit connector nut (313) at the pressure control assembly (40).
4. Swing the conduit (41) away from the pressure control elbow (313).
5. Pull the motor leads through the elbow, one at a time.
6. Loosen the connector nut (39) at the motor and pull the conduit (41) away from the motor, then pull the leads through the conduit, one at a time. See Fig 31.
7. Unscrew the elbow (39) from the motor.
8. Pull the wires through the elbow, one at a time.
9. Remove the front cover and screws (11,13).
10. Use a 5 mm (3/16") hex key wrench to remove the two screws (8) and washers (7) from the recess of the drive housing.
11. Remove the four short screws (110) and two long screws (112) and spacers (111) from the motor shield (1). Remove the shield.
12. Use a 4 mm (5/32") hex key wrench to remove the two screws (78) and washers (79) from the rear of the motor front end bell (L).

## CAUTION

Always pull the motor leads one at a time to avoid loosening the terminals.

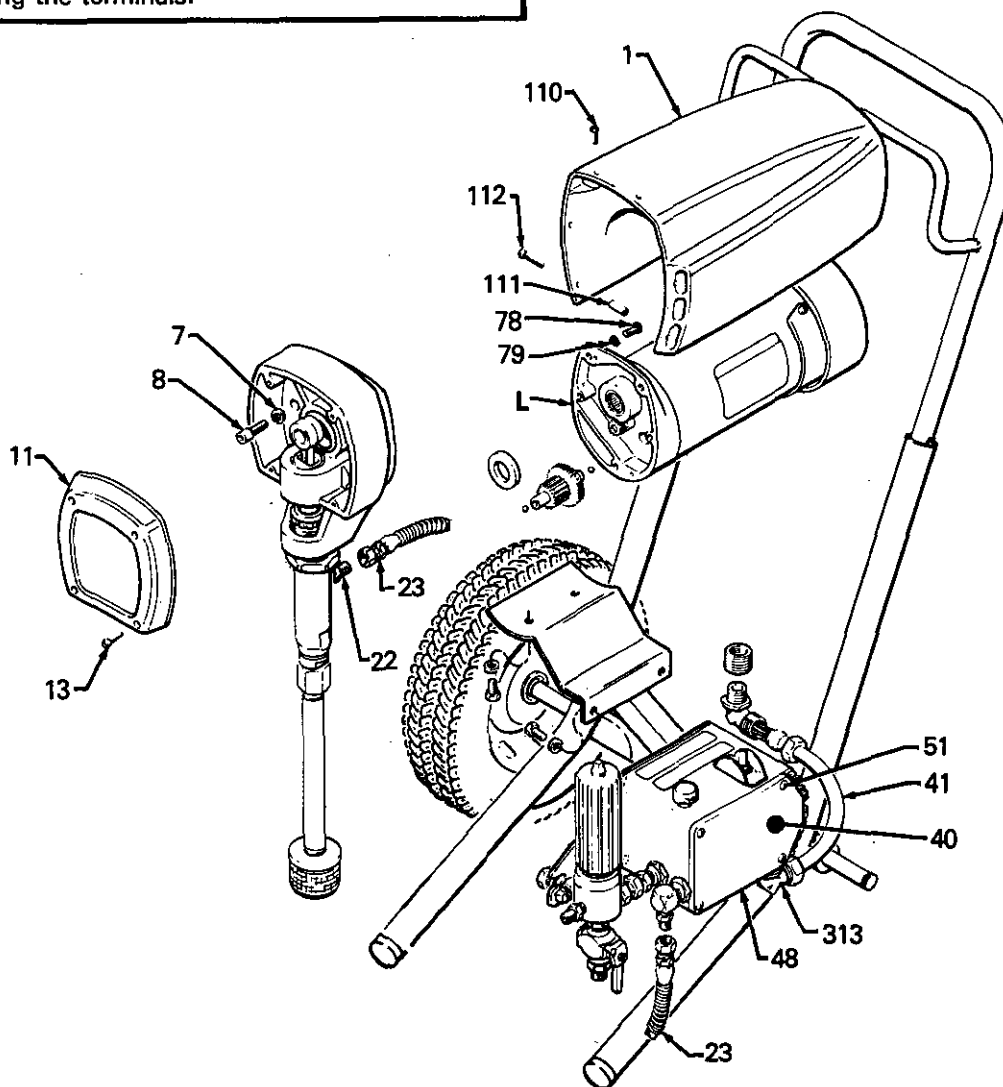


Fig 31

13. Use a plastic mallet to gently tap the displacement pump (19) from the rear to loosen the drive housing (6) from the front end bell. Then pull the drive housing away from the front end bell.

### CAUTION

**DO NOT** allow the gear cluster (26) to fall when removing the drive housing (6). It is *easily* damaged if dropped. The cluster may stay engaged in either the front end bell or the drive housing.

**DO NOT** lose the thrust balls (24) located at each end of the gear cluster (26) or allow them to fall between gears. The ball, which is heavily covered with grease, usually stays in the gear recesses, but could be dislodged. If caught between gears and not removed, the balls will seriously damage the drive housing. If the balls are not in place, the bearings will wear prematurely.

14. Use a 6 mm (1/4") hex key wrench to remove the two screws (35) and lockwashers (34) from the underside of the motor mounting frame. Be *sure to support* the motor to keep the sprayer from *tipping*.

15. Lift the motor assembly off the frame.

16. Place the new motor assembly on the frame and align with the frame mounting holes. Install the screws (35) and lockwashers (34) tightly.

17. Liberally grease the gear cluster (26) and pinion gear (O) and pack all bearings in the motor front end bell. Check to be sure the thrust balls (24) are in place.

18. Be sure the bronze-colored bearing (81a) and the silver-colored bearing (81b) are properly placed on the crank shaft (81).

19. Align the gears and push the drive housing (6) straight onto the front end bell and locating pins.

20. Starting at Step 13 and working backwards, continue to reassemble the sprayer.

**NOTE:** Use a turning motion on the conduit when feeding wires through it.

20. Reinstall the motor shield and pressure control cover.

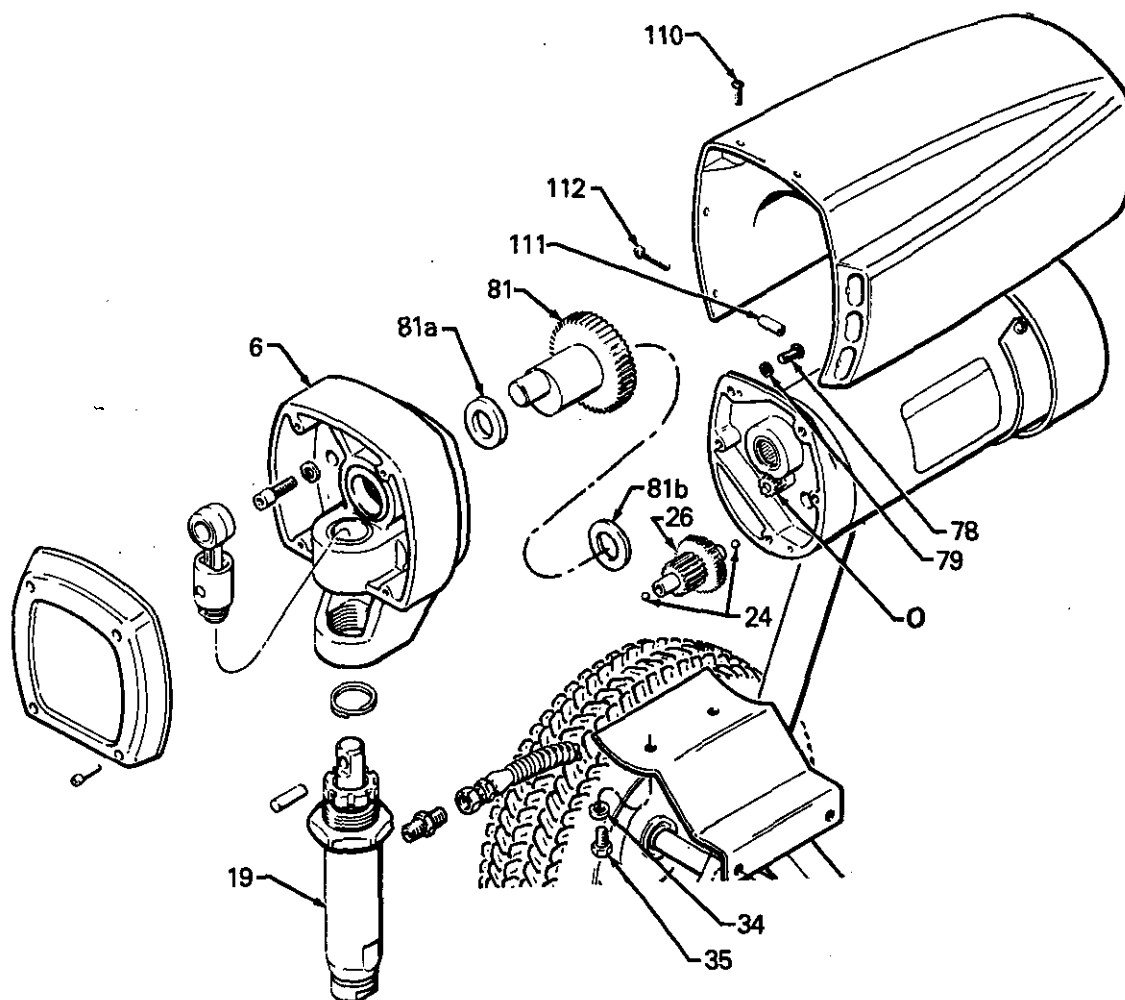
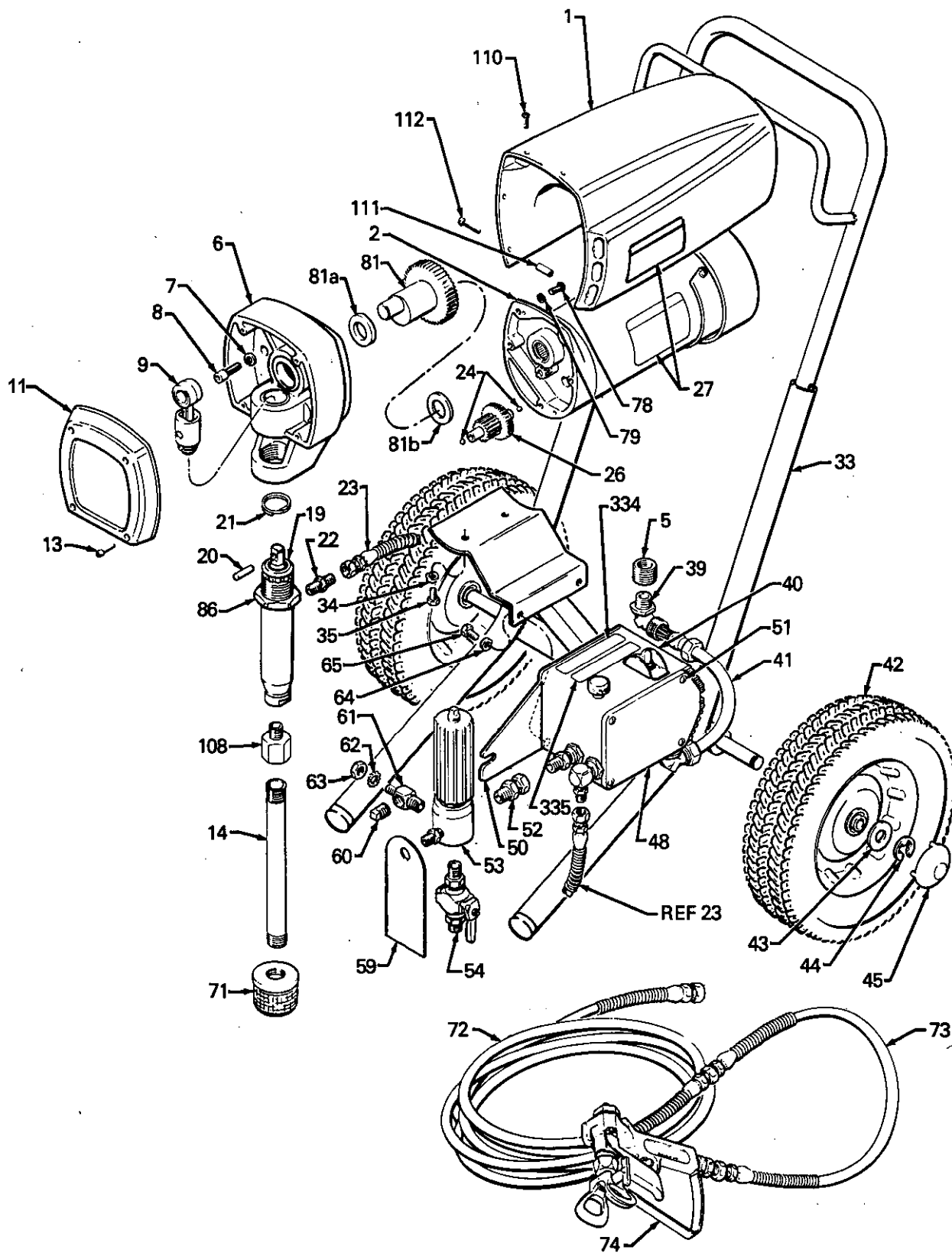


Fig 32

# **PART DRAWINGS AND PARTS LISTS**



**PARTS DRAWING**  
**Model 230-963 Ultra™ 400, Series D**  
 Includes items 1-112



# PARTS LIST

**Model 230-963 Ultra® 400, Series D**  
Includes items 1-112

REF NO.	PART NO.	DESCRIPTION	QTY	REF NO.	PART NO.	DESCRIPTION	QTY
1	181-612	SHIELD, motor	1	54	210-657	BALL VALVE; 1/4 npt (mbe)	1
2	218-415	MOTOR, electric; 112 HP	1			Refer to 306-861 for parts	1
		Includes items 3, 4, 5, one of item 24	1	59	*178-034	TAG, warning	1
3	107-267	. TERMINAL, insulated	1	60	100-509	PLUG, pipe	1
4	107-264	. TERMINAL; insulated	1	61	179-945	ADAPTER, elbow; 7/16 unf(m)	1
5	107-219	. BUSHING	1			x 114 npt(m) x 114 npt (f)	1
6	220-270	HOUSING, drive	1	62	100-322	WASHER; 7/16	1
7	105-510	LOCKWASHER; 114"	3	63	150-513	NUT, jam. hex; 7/16"	1
8	107-445	SCREW, cap, socket-head;	3	64	100-214	LOCKWASHER; 5/16"	2
		1/4-23 x 1 1/2"	3	65	100-001	SCREW, cap, hex; 5/16-18 x 518"	2
9	218-359	CONNECTING ROD ASSEMBLY	1	71	181-073	STRAINER	1
11	218-363	COVER, drive housing	1	72	210-541	HOSE, grounded, nylon; 114" ID;	1
13	107-209	SCREW, machine, fil. head; 8-32 x	4			50 ft (15 m) long; spring guard both	1
		1"	1	73	214-701	HOSE, grounded. nylon; 3/16" ID;	1
14	180-192	TUBE, siphon	1			3 ft (0.9 m) long; spring guard both	1
19	220-647	PUMP, displacement	1	74	220-955	GUN, airless, contractor;	1
		Refer to 307-793 for parts	1			See 307-614 for parts	1
20	176-818	PIN, straight, headless	1	78	107-423	SCREW, cap, button head;	2
21	176-817	SPRING, retaining	1			1/4-20 x 5/8"	2
22	162-453	NIPPLE; 114 npsm x 1/4 npt	1	79	100-028	LOCKWASHER; 1/4"	2
23	218-083	HOSE; grounded, nylon; 114" ID;	1	81	218-242	CRANKSHAFT ASSEMBLY	1
		29" (736 mm) long; spring guard	1			Includes items 81a, 81b	1
		both ends	2	81a	180-131	. BEARING	1
24	100-069	BALL; 1/4"; SST	1	81b	107-434	. BEARING	1
26	218-364	GEAR CLUSTER	2	86	176-762	NUT, hex	1
27	*178-934	LABEL, warning	1	105	107-447	SEAL, conduit	1
33	218-361	CART FRAME	2			(see page 34 for location)	1
34	104-008	LOCKWASHER; 5/16	1	108	178-460	ADAPTER; 3/8 npt(m) x 1/2 npt(f)	1
35	107-212	SCREW, cap, socket-head; 5/16-18 x	2	110	108-865	SCREW, machine, pan-head;	4
		1/2"	1			8-32 x 3/8"	2
39	102-932	CONNECTOR, conduit	1	111	108-663	SPACER	2
40	218-353	PRESSURE CONTROL ASSY;	1	112	108-709	SCREW, machine, pan-head;	2
		See separate parts list on page 34	1			10-24 x 1"	2
41	065-099	CONDUIT, electrical 7.5" (109.5 mm)	2				
42	106-062	WHEEL	2				
43	176-884	WASHER, back-up	2				
44	101-242	RING, retaining	2				
45	104-811	CAP, hub	2				
48	218-326	COVER, pressure control	1				
50	179-936	BRACKET, mounting	1				
51	106-075	SCREW, thread-forming; 10-24 x	4				
		1/2"	1				
52	155-665	UNION, adapter; 318 npt (m) x 318	1				
		npsm (f) swivel	1				
53	214-570	FILTER, fluid	1				
		Refer to 307-273 for parts	1				

306 & 307 numbers in descriptions refer to separate instruction manuals.

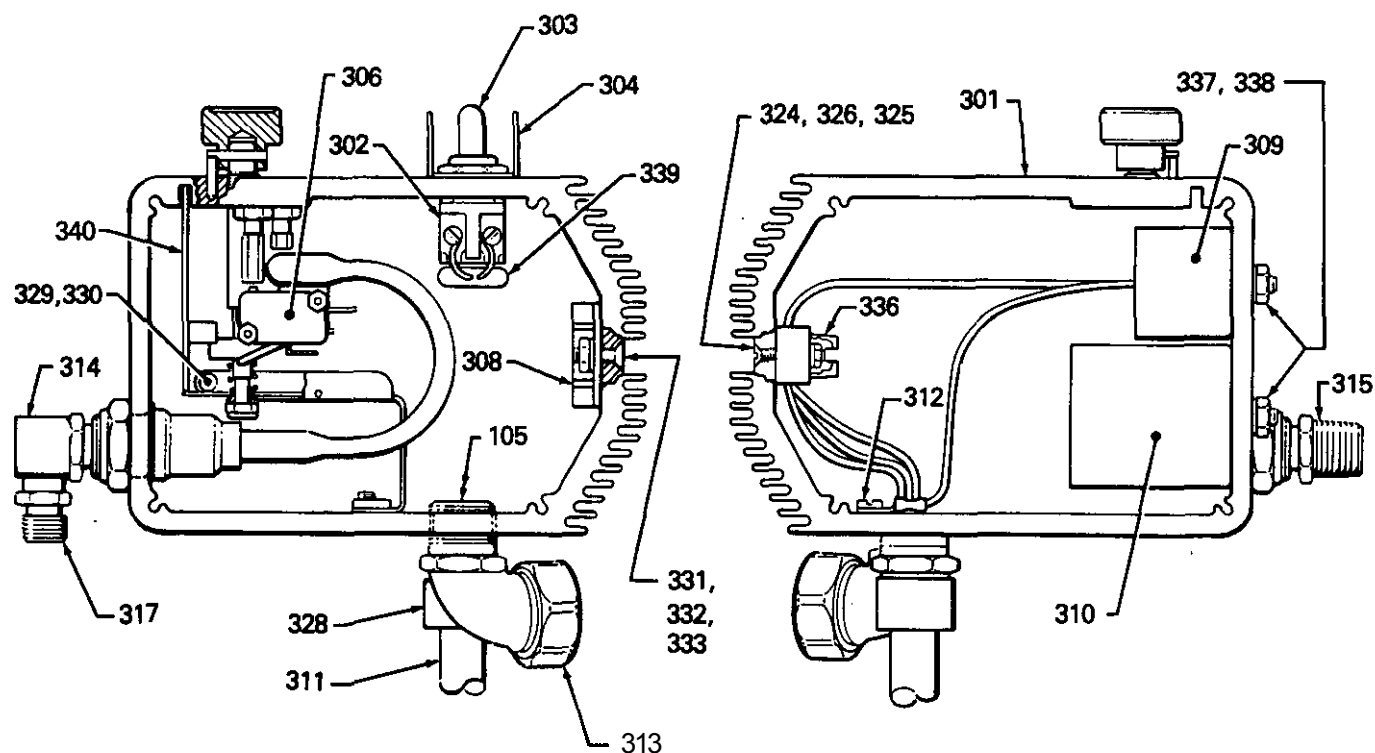
\*Warning labels and tags supplied at no charge.

## HOW TO ORDER REPLACEMENT PARTS

1. To be sure you receive the correct replacement parts, kit or accessories, always give all of the information requested in the chart below.
2. Check the parts list to identify the correct part number; **do not use the ref. no. when ordering.**
3. Order all parts from your nearest Graco distributor.

6 digit PART NUMBER	QTY	PART DESCRIPTION

Ref No. 40  
**PRESSURE CONTROL ASSEMBLY**  
Includes items 301 to 340



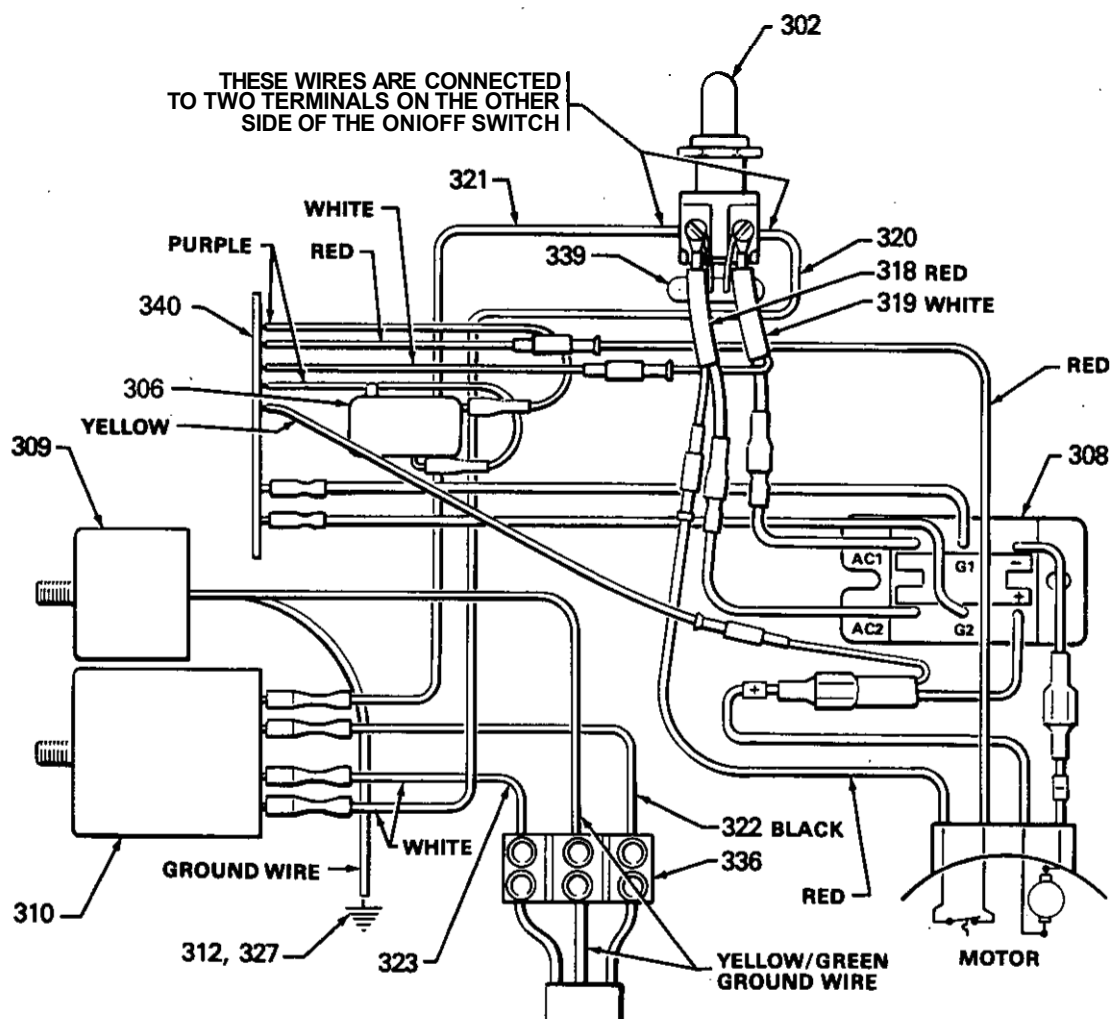
## PARTS LIST

REF NO.	PART NO.	DESCRIPTION	QTY	REF NO.	PART NO.	DESCRIPTION	QTY
301	218-351	BARE PRESSURE CONTROL BOX Includes items 302 to 306	1	324	107-438	SCREW, machine, fil head; No. 5-40 x 5/16" long	2
302	107-437	.ON/OFF SWITCH	1	325	100-975	NUT, hex, machine, No. 5	2
303	105-659	.BOOT, ON/OFF switch	1	326	101-792	LOCKWASHER, external, shakeproof; No. 5	2
304	107-255	.GUARD, locking	1	327	157-021	LOCKWASHER, No. 8, internal	1
306	107-435	.MICROSWITCH	1	328	108-295	BUSHING, strain relief	1
308	218-400	BRIDGE, rectifier, SCR	1	329	107-258	TIP, pin, black plastic	1
309	218-366	CHOKE	1	330	180-041	PIN	1
310	107-427	FILTER	1	331	101-273	SCREW, machine, flat head; No. 10-24 x 5/16" long	2
311	065-140	CORDSET, power supply; no plug	1	332	100-179	NUT, hex, mscr, No. 10-24thd	2
312	100-035	SCREW, mach; slotted pan head; No. 8 x 5/16"	1	333	100-718	LOCKWASHER, internal, shakeproof; No. 10	2
313	102-932	CONNECTOR, conduit	1	334	**178-797	LABEL, WARNING	1
314	100-840	ELBOW, street; 1/4 npt(m x f)	1	335	**178-035	LABEL, WARNING	1
315	157-350	ADAPTER, 3/8 npt(m) x 1/4 npt(m)	1	336	107-436	TERMINAL STRIP	1
317	162-453	NIPPLE, 1/4 npt	1	337	105-329	NUT, hex, M8 x 1.25	2
318	218-365	HARNESS, wire	1	338	100-109	LOCKWASHER, external, shakeproof; 5/16	2
319	218-368	HARNESS, wire	1	339	108-096	VARISTOR	1
320	218-369	HARNESS, wire	1	340	218-355	CIRCUIT BOARD	1
321	218-370	HARNESS, wire	1				
322	218-371	HARNESS, wire	1				
323	218-372	HARNESS, wire	1				

**\*\*Extra Warning labels and tags supplied at no charge.**

**See 'How To Order Replacement Parts' on page 3.**

WIRING DIAGRAM



SERVICE INFORMATION

Listed below by the assembly changed are OLD and NEW parts.

ASSEMBLY PART CHANGED	STATUS	REF NO.	PART NO.	NAME
230-963 Sprayer, Series	OLD	14	218-618	Motor Cover
	NEW	1	181-612	Motor Shield
	OLD	16	217-593	Gun
	NEW	74	220-955	Gun
	OLD	39	218-215	Displ. Pump
	NEW	19	220-647	Displ. Pump
	OLD	47	214-638	Hose
	NEW	23	218-083	Hose
	OLD	58	178-392	Pin
	NEW	44	101-242	Ring
	OLD	135	102-952	Strainer
	NEW	71	181-073	Strainer

**NOTE:** This manual now includes complete service procedures. The parts list has new reference numbers.

Other major changes to the sprayer are the upright cart (33) and changes to the suction tube (14).

**DISCONTINUED MODEL NOTE:** Model 230-964 is obsolete and has been deleted from the manual.

## **ULTRA® 400 TECHNICAL DATA**

Power Requirements : **230 VAC, 50 Hz, 1 Phase, 3.7 AMP** minimum  
Operating Range : **0-192 bar (0-2750 psi)**  
Cycles/Liter (gallon) : **124 (470)**  
Power Cord : **2.5 mm Ø (13 ga.), 3 wire, 6 m (20 ft)** long  
Inlet Paint Strainer : **16 mesh, 1190 micron,**  
Stainless Steel Screen, reusable  
Outlet Paint Filter : **60 mesh, 250 micron,**  
Stainless Steel screen, reusable  
Pump Inlet Size : **314 npt w/30° I.D. chamfer**  
Fluid Outlet Size : **1/4 npsm from fluid filter**  
Weight : **36 Kg (80 lb)** approximately  
Wetted Parts : Aluminum, Delrin®, Nitralloy, Nylon, Ultra-High  
Molecular Weight Polyethylene, Polyurethane, Rubber  
impregnated leather, Stainless Steel, **PTFE**,  
Tungsten Carbide, Zinc-plated steel  
Dimensions : Width: **546.1 mm (21.5 in.)**  
Height: Handle extended: **939.8 mm (37 in.)**  
Handle down: **723.9 mm (28.5 in.)**  
Length: Handle extended: **660.4 mm (26 in.)**  
Handle down: **609.6 mm (24 in.)**

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